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ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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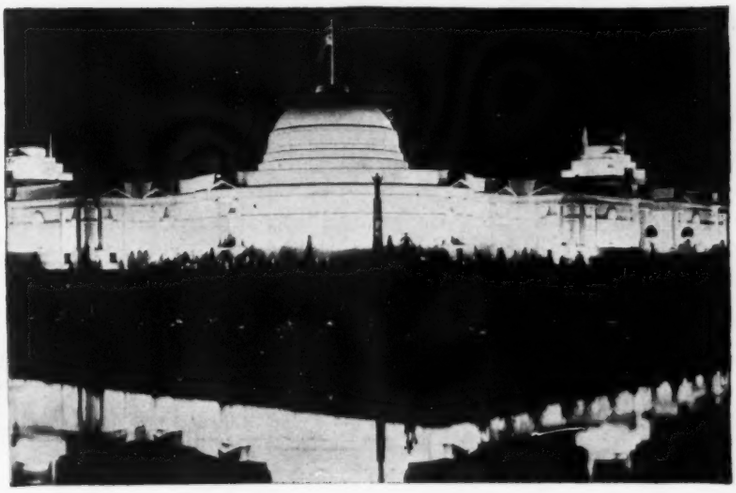

British pavilion
Belgian Centenary Exhibition,
Antwerp

DECEMBER 6, 1930

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"No light has shone at such a depth before!"

WILLIAM BEEBE, the renowned naturalist who dares to do spectacular prospecting in the ocean depths, has descended in a cast steel sphere to observe ocean life at a sub-surface depth of 1426 feet. In one test the empty sphere was lowered to a depth of 2400 feet. Dr. Beebe's associate, Otis Barton, who designed this "Bathysphere," writes us as follows:

October 1, 1930

The Okonite Cable Co.

Dear Sirs:-

Last year you made me 3000 ft. of electric cable for the bathysphere, in which Wm. Beebe and I descended 1426 ft. into the sea. No light has shone at such a depth before. Telephone and light communications were maintained over your cable perfectly.

I thought you might like the enclosed photos for advertising.

Yours truly,
(Signed) Otis Barton

The 3000 ft. cable mentioned contained two No. 8 A.W.G. conductors to operate the powerful lights and two No. 14 A. W. G. conductors for the telephone, all insulated with OKONITE. A 5-32" sheath of OKOCORD protected everything from the unknown strains of this unusual service including hydraulic pressure of over 1000 lb. per square inch.

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OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

ELECTRICAL WORLD

for the Week Ending

December 6, 1930

The government has the principal obligation in safeguarding the interests of navigation and federal properties, but in other respects the control of water-power development is largely a matter of state interest. This involves dual authority and state and federal agencies must properly supplement and not duplicate each other.

R. L. WILBUR,
Acting Chairman
Federal Power Commission.

Hydro questions for states to decide, says Secretary Wilbur

A.S.M.E. tackles unemployment problem at annual meeting

—**A. S. M. E. in annual meeting** in New York. Of special interest to electrical men were: discussions of power interchange with industrial plants and experiences in operating exclusively 1,200-lb. stations—*pgs. 1039, 1044.*

—**California commissioner irate** over rate reductions, voted by State Railroad Commission for Los Angeles Gas & Electric, seeing them as confiscatory. Viewing general situation askance, he foresees "an era of regulation by the courts"—*p. 1028.*

—**President addresses Congress.** In message to legislators he advocates, among other things, completion of Muscle Shoals legislation. Earlier pronouncement on regulation of interstate power reapproved—*p. 1027.*

—**Niagara Falls Power objects** to increased levy by state board for water diverted for power production. Writ of certiorari halts rental increase. Yes, an investigation to follow as usual—*p. 1028.*

—**Scientific sleet-melting rules** to eliminate the guesswork in clearing winter-grasped lines! This sort of thing may or may not tend to make an operator's life a happy one—*p. 1053.*

—**Engineers fight unemployment** problem as Arthur Woods of the President's committee urges at A.S.M.E. annual meeting that constructive measures be adopted at once—*p. 1025.*

—**Industrial-utility substations** are a mutual problem in service, investment and operating costs. Co-operation needed here too if there is to be maximum satisfaction to contracting parties—*p. 1048.*

—**Artificial sunlight now here.** At a Chicago radio broadcasting studio, dual-purpose lighting, installed where natural light is excluded, marks a long-predicted step in the progress of our high-speed civilization—*p. 1035.*

NEWS OF THE WEEK

States' Responsibility Is Stressed by Federal Power Board

CONTROL over water-power developments is declared to be primarily a responsibility of the individual states in the annual report of the Federal Power Commission just made public by Ray Lyman Wilbur, Secretary of the Interior and acting chairman of the commission. The report cites complaints made by state authorities that the government in some instances has been inclined to encroach upon the rightful field of state activity to such extent that confusing duplication of authority occurs.

In this connection the report maintains that "clearly the government has the principal obligation in safeguarding the interests of navigation and the federal properties that may be affected by water-power projects, but in other respects the control of these developments is largely a matter of state interest. Since this situation involves a considerable degree of dual authority, there are present the elements of possible conflict and confusion which might seriously impede desirable developments unless the state and federal agencies find a basis whereby each may properly supplement and not duplicate the other."

The total capacity of all the licensed plants which have been completed and placed in service now amounts to 2,608,868 hp. This capacity is equivalent to about 24 per cent of all the hydro capacity and slightly less than 6 per cent of the total generating capacity in public utility service throughout the country. About 80 per cent of all the capacity operating under Federal Power Commission license is confined to four states —Alabama, California, Maryland and New York. In 27 states there are no plants whatever operating under the authorization of the act.

Even in the regions of abundant water-power resources, says the report, the steam-electric plant is assuming a position of rapidly increasing importance and demonstrating its capacity to compete on even terms with hydro power. The production statistics for 1929 show for the first time in ten years a failure of hydro power to record a gain in output. During the same period the energy manufactured by fuel plants increased nearly 10,000,000,000 kw.-hr. Preliminary figures show that 1930 will about equal the 1929 output, but the proportion generated from water power will probably be even less owing to widespread droughts and the trend toward fuel-using plants.

Relative to the growing use of electricity the commission states: "The new census figures have made possible for the first time since 1920 reliable calculations of the per capita production of electricity. These statistics strikingly demonstrate the extent to which all sections of the country are making wider use of electric power. For the country as a whole the per capita demand has more than doubled in the last decade, increasing from 391 kw.-hr. in 1920 to 800 kw.-hr. in 1930. From the standpoint of water-power development, it is significant that in general the regions having the highest per capita consumption are also those in which a large proportion of the energy is generated from water-power sources." On the other hand, the report continues, the modern steam-electric station now offers keen competition with the hydro-electric plant, and with the wide distribution of cheap fuel supplies the cost of producing electrical energy has been equalized throughout the country to a considerable extent.

▼

New River "Minor Project" License to Wait on Court

NO "MINOR PROJECT" LICENSE for a site on the New River, in Virginia, was issued by the Federal Power Commission to the Appalachian Electric Power Company when the matter reached it in due course on November 25. Secretaries Wilbur and Hyde met—the third member of the commission, Secretary Hurley, being away from Washington—and determined to withhold the license, Chairman Wilbur explaining that this was done so as to get a final decision

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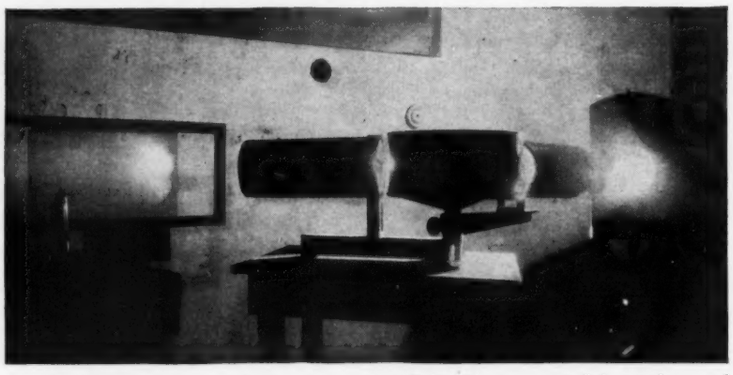
SPREADS ULTRAVIOLET SPECTRUM FOR STUDY



With this large monochromator using 7-in. lenses and 5-in. prisms of clear fused quartz E. E. Free has been able to spread the ultraviolet spectrum between 2,200 and 4,000 Angstroms over 13 in., so that the individual wave lengths may be isolated for individual study and experimentation.

from the courts on the legal points involved in the situation.

The company is said to have contemplated starting construction without a license, the commission then presumably seeking an injunction against it. After a conference with Department of Justice officials, representatives of the Appalachian Electric Power Company are reported to doubt justification for starting such construction.

There had been much agitation in political and newspaper circles against the issuance of the "minor project" license, application for which was based upon Attorney-General Mitchell's decision that the Federal Power Commission had no jurisdiction over developments on non-navigable tributaries of a navigable river except in so far as such developments might interfere with navigation on the main stream, and that therefore the commission could not review or upset the company's statement of pre-license costs. This interpretation of the water-power act would, in the opinion of the critics of the Attorney-General's finding, destroy the efficiency of the legislation. (See ELECTRICAL WORLD, October 25, page 760.) The commission's own counsel, Charles A. Russell, shares this view. Executive Secretary Bonner, on the other hand, holds that regulation can be safely and properly intrusted to the states concerned. A point made by the opponents of the license was that so important a document should not be issued by the present commission, which will pass out of office as soon as the Senate confirms President Hoover's new nominees.

▼

Engineers Back Effort to End Unemployment

A PLEA FOR CO-OPERATION made by Colonel Arthur Woods, head of the President's emergency committee on unemployment, to the American Society of Mechanical Engineers, at its annual meeting in New York this week, led the society to appoint immediately a committee of five members who will conduct a nation-wide investigation to ascertain how some employers have stabilized employment during periods of depression. This action will bring into play the efforts of the entire engineering profession under the direction of the American Engineering Council, which embraces about 30 national and local engineering associations.

Colonel Woods emphasized the necessity of finding the ultimate cause of industrial depression rather than merely trying to remedy specific symptoms. He pointed out that there are abundant plant and facilities, and abundance of capital and an abundance of idle workers willing to work, but no one has yet solved the problem of how to bring them together. He discussed a number of tangible plans, some of which have already been proved by years of use, such as the Procter & Gamble profit-sharing plan, the employees' fund of Leeds & Northrup of Philadelphia and somewhat similar plans operated by the Brown & Bailey Paper Box Company and the Dennison Manufacturing Company. Colonel Woods referred also to the unemployment plan recently inaugurated by the General Electric Company, the starting date of which was advanced to meet the emergency. He said in part:

This problem of unemployment is, in one sense, a problem of human relations. It is a problem to which the mind of the engineer can be addressed with the expectation of practical results. It is my own belief that if the engineers of America could apply the same degree of trained intelligence to this problem of the stabilization of American industry that they have in the past to the expansion of American industry, we should march a very long way onward toward the regularization of employment. That, in a word, is the challenge of this emergency to the engineers.

We must be fundamental enough in our thinking to realize the necessity of trying to find out what started this economic typhoon. Collectively we must seek the reasons. Our industrial system finds itself in a grave, stupid and anomalous situation. I submit that industrialists, economists, engineers and statesmen should now address themselves wholeheartedly to the correction of this stupid situation, with a fixed determination to stay on the job until it has been mastered.

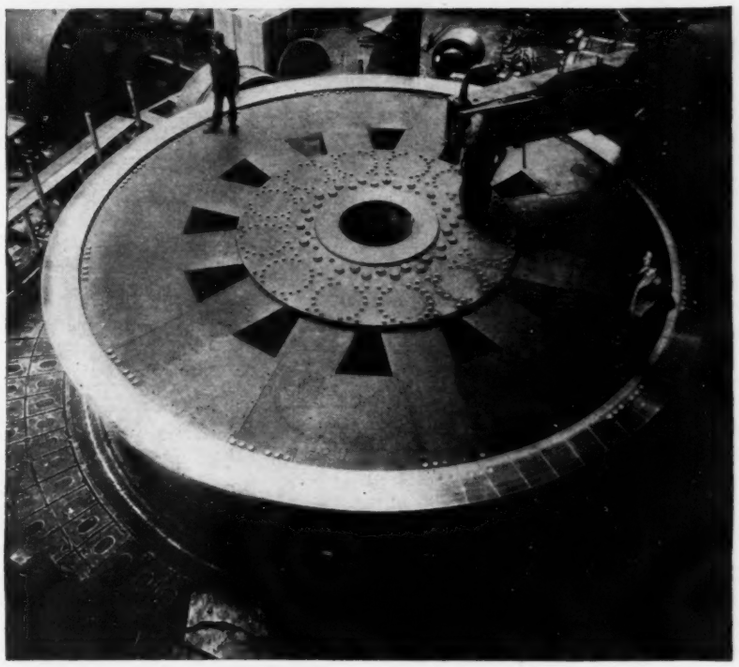
▼

Trade Investigators Reach Georgia Power Company

TESTIMONY REGARDING THE corporate set-up of the Georgia Power Company was offered before the Federal Trade Commission by its own investigators at the resumed hearings in connection with the commission's public utilities inquiry. The history and corporate relationships of the company were outlined by Carl Harmon Depue, a commission accountant. Judson C. Dickerman, an expert public utilities engineer of the commission's staff, described the physical structure of the company's system and supplied details relating to the company's development and the part it plays in the growth of industrial Georgia.

The Southeastern Power & Light Company, it was testified, acquired the

TO BE DISASSEMBLED AND SHIPPED TO RUSSIA



This rotor spider, measuring 29 ft. 6 in. in diameter, 5 ft. 8 in. in height and weighing 96½ tons, is part of the hydro-electric equipment now under construction at the Schenectady works of the General Electric Company for the Soviet's Dnieper River plant. The rim of this "pinwheel," which is here shown upside down, will travel at the rate of 100 miles per hour.

▼ ▼ ▼

common stock of the Georgia Railway & Power Company, which was later consolidated with the Georgia Power Company and carried this stock at $230 a share. Before acquisition, the Georgia Railway & Power Company carried the stock at $115 a share. The higher valuation was placed on the stock-for-stock exchanges in connection with the merger, it was declared.

This difference in common stock valuation, which resulted in an appreciation of more than $28,000,000, was accomplished by exchanging the shares of Georgia Railway & Power for shares of the Southeastern company, the testimony revealed.

One of the high points in Mr. Dickerman's testimony was his complimentary description of the systematic utilization by the company of hydro facilities when available and the speeding up of steam generation when river flow is at a minimum.

In the last few years, Mr. Dickerman stated, there have been several rate reductions effected by the company, and in each instance he noted the rate reduction was followed by a considerable increase in the amount of energy consumed. Rates for domestic service and for commercial light and power, he remarked, are uniform all over the territory served by the Georgia Power Company.

▼

Binghamton Sale Approval Reaffirmed by Commission

NEW YORK STATE'S Public Service Commission has reaffirmed its order of last year consenting to the transfer of the franchises, works and system of the Binghamton Light, Heat & Power Company to the New York State Electric & Gas Corporation.

The two companies petitioned the commission last year for consent to the transfer of the property of the Binghamton company to the New York State corporation. The commission issued an order granting the petition and consenting to the proposed transfer.

After the issuance of the commission's order the proceeding was reopened because of complaints by minority stockholders of the Binghamton company.

The rehearings in the case were held (ELECTRICAL WORLD, November 22, page 939) and proof was presented to show that the stockholders were notified of the meeting at which the transfer was approved and that the meeting was duly held. Other evidence was presented to show the legality of the proceeding and made part of the record in the case. Questions arose as to conflicting rights of majority and minority stockholders, but over these matters the commission has decided that it has no jurisdiction, taking the position that it is not a court of equity and that these stockholders will have to resort to a court of law for an adjudication of their contentions The commission therefor reaffirmed its previous order and assures that the transfer of the Binghamton company's property to the New York State corporation is in accordance with law and is a valid transfer.

▼

BIG EQUIPMENT FOR SEATTLE

The diameter of this steel-plate penstock "Y," belonging to Seattle's Diablo Dam on the Skagit, is 19.5 ft. for the main section, while each one of the smaller sections measures 15 ft. The "Y" was fabricated by the Commercial Boiler Works, Seattle.

▼

Consolidation to Save Million for Consumers

A SAVING TO CONSUMERS of $1,000,000 annually would be effected by the proposed sale of 27 small independent power companies to the Pennsylvania Power & Light Company, John S. Wise, Jr., of Allentown, president of that organization, said last week at a special hearing by the Pennsylvania Public Service Commission. The transfer of the properties was not opposed. (ELECTRICAL WORLD, November 15, page 893.)

The commission announced that no further hearings would be held, but requested Mr. Wise to furnish by correspondence specific data on the value of the companies involved, which are in Lancaster, Union and six other contiguous counties.

▼

Ohio Commission Acts to Promote Rural Service

FIVE POWER COMPANIES have been cited by the Ohio Public Utilities Commission to appear within fifteen days to show cause why they have not made arrangements for extending rural electric service by making extensions and filing rates. The companies are the Western Reserve Power & Light Company and the Reserve Power & Light Company of Cleveland, the New London Power Company, the General Utilities Company of Deshler and the Ohio Northern Public Service Company of Bowling Green.

At the same time the commission rendered a decision to the effect that the Columbus, Delaware & Marion Electric Company's tariffs do not permit it to accept connection charges and fees in furnishing service to rural applicants.

▼

A. S. M. E. to Co-operate with Power Commission

A REITERATION BY THE executive secretary of the Federal Power Commission, F. E. Bonner, of the policy and temper of the commission as portrayed in the annual report of its acting chairman, Ray Lyman Wilbur, Secretary of the Interior, was contained in Mr. Bonner's address to the hydraulic section of the A.S.M.E. on Tuesday (see page 1024). The feature which advocates full co-operation with the states in their regulatory function, with retention in the federal jurisdiction only of preservation of navigation and federal land prerogatives, brought a dissent from Prof. Guido H. Marx of California, who injected the word "non-feasance" into his vigorous denunciation.

After a discussion of the paper and the general incidence of regulated water-power development upon the engineering profession, action was taken to provide an engineering advisory board to co-operate with the Federal Power Commission. The division voted to ask the society council for authorization of a committee to function jointly with others from the American Institute of Electrical Engineers and the National Electric Light Association, under the auspices of American Engineering Council. It was believed that such a body would be welcomed by the Federal Power Commission as a means

of integrating the national engineering and economic thinking through impartial channels and thus counteract the concerted political and radical influences which have dominated the representations in previous deliberations.

▼

Hoover Urges Action on Muscle Shoals Legislation

IN ADDRESSING THE THIRD, and last session of the Seventy-first Congress President Hoover, after discussing the general economic situation and other factors of present importance, urged the completion of partially finished legislation. Muscle Shoals was specifically included, but no indication of preference for any of the several pending bills on this project was voiced. Dismissing electric power problems with "I have in a previous message recommended effective regulation of interstate electrical power. Such regulation should preserve the independence and responsibility of the states," Mr. Hoover reiterated his hopeful attitude toward the future.

Agreement in Congress on Muscle Shoals legislation seems far from being attained, despite some concessions proposed in the House. Senator Norris apparently will be satisfied with nothing short of an out-and-out public operation setup. The so-called compromise suggestions which will be submitted to the conference committee by Representative Reese of Tennessee appear unlikely to receive approval in the Senate.

Under the House proposal the rates for the surplus power are to be fixed by the state public service commissions instead of by the Federal Power Commission, as proposed by Senator Norris. This is not a point on which Senator Norris is likely to yield. Moreover, the House measure eliminates authority for the government to construct transmission lines. On this point as well Senator Norris is likely to insist. On the other hand, several of the champions of Muscle Shoals are obdurate in their refusal to accept any plan that does not require the production of fertilizer. The Norris measure calls for nothing more than experiments in fertilizer production.

After returning to Washington and discussing the legislative situation with his colleagues, Senator Black of Alabama declared last week that he will insist upon an extra session if the Norris Muscle Shoals bill is not passed. Senator Black stated that a solution of the Muscle Shoals problem will aid materially in relieving the farm situation and in reducing unemployment.

▼

Economic Conditions as Factor in Rate Valuation

POINTING OUT THAT THE Supreme Court of the United States has never held that the sole basis for determining the value of utility property is the cost of reproduction, Suel O. Arnold, counsel for the Wisconsin Railroad Commission, told that court on November 24 in an appeal brought by the commission against a lower court's decision for W. G. Maxey, receiver for the Washburn Waterworks Company, that the commission's valuation of the company's property was not arbitrary or confiscatory, as the company claimed. The commission had denied a request for a large increase in rates, holding that a small increase would earn a 7 per cent return upon a reasonable value.

Economic factors, such as decline in population, diminution in property values and scarcity of industry, in the city of Washburn were cited as reasons for fixing the value of the property at a sum which the company assailed as confiscatory. Decision was reserved.

▼

New Power Commissioners Up for Senate Approval

PRESIDENT HOOVER on Wednesday sent to the Senate his recommendations for the new personnel of the Federal Power Commission. The present board would be relieved in its entirety by the proposal. The names and the year in which their appointments would expire are as follows: George Otis Smith, Director of the U. S. Geological Survey (1935); Frank McNinch, former Mayor of Charlotte, N. C. (1934); Frank B. Williamson, attorney acting in reclamation problems in Washington State (1933); Marcel Garsaud, formerly general manager of Board of Commissioners for the Port of New Orleans (1932), and Claude L. Draper, chairman of the Public Service Commission of Wyoming (1931).

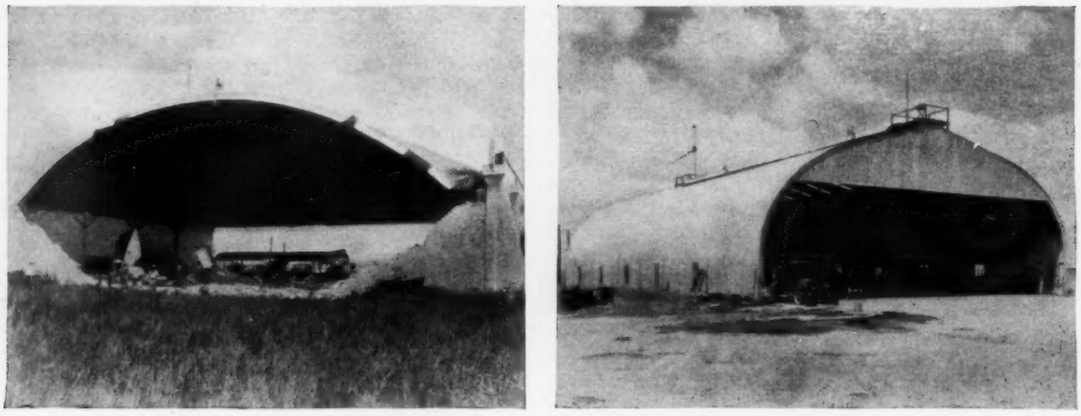
It is probable that in the event of the acceptance and approval of the nominations by the Senate Mr. Smith will be chairman of the commission. Messrs. Williamson, Garsaud and Draper were recommended previously by President Hoover, but no action was taken by the Senate at that time.

▼ ▼ ▼

SAFE HARBOR HYDRO SITE, ON THE SUSQUEHANNA RIVER

Taken a few weeks ago, this photograph shows about half the area inside the first cofferdam on the site where the Safe Harbor Water Power Corporation is pushing work on its coming 255,000-hp. development —which may ultimately reach twice that size—above Holtwood and 17 miles from the Pennsylvania-Maryland state line. The plant is scheduled for operation in 1932. The bulkhead section of the dam is seen on the right.

ARC-WELDED HANGARS DEFY BOREAS, MASONRY SUCCUMBS



A "Texas twister" is an erratic performer, and it is impossible to say that the three arc-welded hangars on the Houston airport were subjected to the same stresses as was the wrecked masonry structure shown on the left. But the fact remains, as do the three steel sheds, that one was wrecked and three were not.

▼ ▼ ▼

California Commissioner Calls Rates Confiscatory

WHEN THE CALIFORNIA RAILROAD COMMISSION last week, by a vote of four to one, ordered substantial reductions in the domestic and commercial gas rates of the Los Angeles Gas & Electric Company, the dissenting commissioner, Ezra W. Decoto, filed a vigorous protest in which he said:

From time to time the federal courts have stepped between the opposing views as to regulation held by certain state commissions and the utilities and have consistently pointed out the proper method of fixing a rate base. For 32 years the Supreme Court of the United States has consistently adhered to the controlling principles of valuation laid down by it. In spite of the fact that the pathway is now made reasonably clear by the decisions of the courts some state commissions seem to be inclined to be a law unto themselves and persist in ignoring the law as laid down by the courts.

The California commission has, to outward appearance, been one of these. It has clung ostensibly and theoretically to the historical rate base, but in reality it has given effect to the different elements mentioned by the federal courts, including fair value and going-concern value, by allowing a rate of return between 8 and 8½ per cent on historical cost. With this arrangement our public utilities have been content.

During the last two years this commission has shown a tendency to cut the rate of return upon a historical rate base from between 8 and 8½ per cent to 7 per cent, which reduced the rate of return upon a fair-value basis to 6.12½ per cent to 6.3 per cent. This is confiscation and not regulation. It cannot be expected that our public utilities will long content themselves with such a return. The result will be an appeal to the courts for proper redress. This is in effect a shirking of its responsibility by the commission and will lead to an era of regulation by the courts. . . .

The majority opinion fixes the return to the company at 6.8 per cent on historical value with going value included and 6.3 per cent upon fair value fixed in accordance with the decisions of the courts. This is less than the cost of money to the company and is clearly confiscation. If the commission still persists in adhering to the historical-cost rate basis, it should adhere to its past practice and allow a return of between 8 and 8.5 per cent.

▼

Reading Electrification Program Is Amplified

COMPLETE ELECTRIC OPERATION of various sections of the Reading Railroad will begin on July 1, 1931, according to President Agnew T. Dice. One of the electrified lines will extend from the Reading Terminal in Philadelphia to Wayne Junction and thence to Jenkintown, Langhorne and West Trenton; another branch will run from Jenkintown to Glenside and Hatboro, and a third from Glenside to Lansdale and Doylestown. Electrification within the Philadelphia city limits from Wayne Junction to Chestnut Hill will not be finished so soon, because of the many grade crossings to be eliminated.

This represents in the aggregate an amplification of the railroad's original program of electrification, which included 50 route miles and 120 single-track miles, to 69 route miles and 161 miles of single track. It will add about $1,500,000 to the twenty-million-dollar project. An average saving in time of from 20 to 25 per cent is looked for.

It is expected that a second step will follow the first. Electrification will be extended from West Trenton to Bound Brook and ultimately to New York and from Lansdale to Bethlehem. Electrification of the Schuylkill Valley lines probably also will be undertaken. It is estimated that this contemplated construction will cost an additional $32,000,000.

▼

Niagara Falls Power Contests Water Charge

OBJECTING STRENUOUSLY to an action taken in October by the New York State Water Power and Control Commission by which the Niagara Falls Power Company was subjected to a future rental charge of $52,500 a year for diversion of 500 sec.-ft. from the Niagara River, while the amount due for diversion of water from October 26, 1925, to October 9, 1930, was put at $175,486, that company obtained last week a writ of certiorari from the State Supreme Court. Company officials declared that the business and prosperity of large manufacturing plants in western New York and in the city of Niagara Falls dependent upon low-priced electrical energy is seriously jeopardized by these high rental charges.

As a result of the writ, the commission must review all the proceedings which resulted in the determination of rental to be charged the power company within 20 days of being served.

The company has not received as much as 6 per cent per annum return upon the value of its property used in development and transmission of this power, according to Vice-President A. D. Robb, who said that conditions at Niagara Falls are different from those at Rochester or other more eastern points on the Barge Canal in reference to the prices obtainable for power and the property rights of the state.

The rental charges are based upon an erroneous conception of the law and of the value of the use of water for power purposes elsewhere than at Niagara Falls, and on the cost of the production of electric power by other means than with water, the petitioner argued.

▼

Public Ownership Measure Now Law in Nebraska

THE OFFICIAL VOTE OF NEBRASKA discloses that the Public Ownership League initiated law carried by a vote of 240,579 to 89,205. As the total vote was 451,904 and the affirmative vote exceeded 35 per cent thereof, it became a law when the Governor's proclamation was issued soon after the canvass was complete. Under this law, as before explained, cities and towns owning lighting and power plants may, provided that cost is paid out of net earnings, extend their lines beyond the corporate borders by vote of Council and may pay for power plants and systems by pledging future earnings instead of by taxation. The law requires a 60 per cent vote of the people to sell a publicly owned plant, limits the expenses of elections called for that purpose and compels filing of reports of costs of plants to be sold.

By a vote of 155,107 to 144,595, the proposal requiring a vote of the people to make extensions or purchases was beaten. A third proposal, which permitted sale of plants by a majority vote, was beaten, 162,050 to 118,617.

Three municipal plants were purchased by power companies the week before the canvass was completed.

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Coming Meetings

Pacific Coast Electrical Association—Engineering Section, Los Angeles, Dec. 10-12; Purchasing and Stores Section, Los Angeles, Dec. 11-12; Commercial Section, Los Angeles, Jan. 8-9. S. H. Taylor, 447 Sutter St., San Francisco.

American Engineering Council — Annual meeting, Washington, D. C., Jan. 15-17. L. W. Wallace, 26 Jackson Place, Washington.

National Electrical Manufacturers' Association — Midwinter meeting, New York headquarters, Jan. 19-23. A. W. Berresford, 420 Lexington Ave., New York.

American Institute of Electrical Engineers — Winter convention, New York, Jan. 26-30; district meeting, Pittsburgh, March 9-13. F. L. Hutchinson, 33 W. 39th St., New York.

North Central Division, N.E.L.A.—Commercial meeting, Nicollet Hotel, Minneapolis, Jan. 26 and 27; engineering meeting, Minneapolis, Feb. 23 and 24. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Midwest Power Engineering Conference—Chicago, Feb. 10-13. G. E. Pfisterer, 308 W. Washington St., Chicago.

Alabama Power for First Time Uses Gorgas No. 2

OWING TO THE DROUGHT during the summer months, the Alabama Power Company operated its reserve steam plant No. 2 at Gorgas for eleven days during November to help hydro-electric plants carry the peak load of the company. This was the first time the steam plant had been operated since its test run following completion in August, 1929.

The plant had been held in readiness for operation since early in August, but timely rains made this unnecessary until November 3, when it was turned on. It was shut down November 13 after generating 5,453,000 kw.-hr. and consuming 3,796 tons of coal. It was necessary to operate the plant for this period despite the purchase of the company of about 275,000,000 kw.-hr. from Wilson Dam and the withdrawal of water from the Martin Dam reservoir to the lowest point that has been reached in that storage source.

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Effects of the Drought in Upstate New York

WITH RIVERS AND SMALLER STREAMS at the lowest point in 30 years, power users in northern New York who depend on hydro-electric power are said to be apprehensive over conditions which may result unless heavy rains occur between now and the time winter sets in. A Potsdam dispatch says that a small hydro-electric plant on the Racket River which under ordinary conditions was capable of supplying 2,300 kw. of electrical energy is at the present time able to furnish only 300. This condition is said to be typical of that prevailing on all the streams in that section of the state.

A dispatch from Watertown says that low water is hampering mills in that territory. The Stillwater reservoir is said to be down to 20 per cent of its capacity, and there is only a month's supply at present draft left to meet the needs of factories on the Black River. Stillwater is at the lowest point since it was enlarged in 1924, according to E. S. Cullings, secretary of the Black River Regulating Board, and the smaller storage reservoirs on the Black River are empty.

Stillwater reservoir is being drawn on for only about half of what was taken from it during the summer months. Storage water has kept the mills in the Black River district operating since July, when the drought started, and without the storage water mills on the river would have had to close down. Rainfall since July in the district has been from six to seven inches below normal.

Further south the Lake Lamoka power plant, which is the subject of litigation with contractors because of alleged defective construction of the penstock, has not been operated for several months because of the low water.

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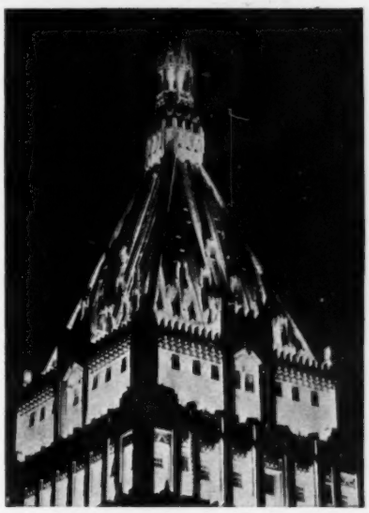
LIGHTS IN THE SKY



The tower of the Bank of Manhattan Building, the highest on Wall Street, New York, is beautified at night by floodlight projectors.

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Hinton Dam Site on New River Called Safe

UNDER SPECIFIED CONDITIONS "there is no reason to believe that a safe dam cannot be constructed at the Hinton Dam site" of the West Virginia Power Company. A report to this effect was filed with the Public Service Commission of West Virginia on November 26 by W. S. Downs, Morgantown, consulting engineer employed by the commission. The report was made on the proposal of the company, a subsidiary of the Appalachian Electric Power Company, to undertake hydro-electric developments at Hinton and Bull Falls on New River at an estimated cost of $22,926,000.

The report made by Mr. Down is confined almost exclusively to the Hinton project, with the explanation that the Bull Falls plant will be "a subsequent stage of development" as to the practicability of which the engineer is satisfied, though additional information is desirable. (ELECTRICAL WORLD, October 11, page 675.)

470,000 Hp. Safeguarded on the Gatineau

Upon completion of the installation of the seventh unit (34,000 hp.) at the Paugan plant of the Gatineau Power Company this station will have an installed capacity of 238,000 hp. Within a 26-mile stretch on the Gatineau River, Quebec, 470,000 hp. will then be developed. Water shortages here are improbable, for the Mercier and Cabonga storage basins impound more than 145,000,000,000 cu.ft.—enough to operate the plants on the Gatineau River at full capacity practically eight hours every working day for a year.

EDITORIALS

L.W.W.MORROW
Editor

Unemployment—
a co-operative answer

PERIODS of widespread unemployment occur from time to time. It is contrary to good principles to adopt a governmental dole system to maintain the unemployed. Industry is able and willing to take care of intermittent unemployment conditions and is trying to remedy basic conditions that bring lack of work about. This is the sound method for handling the present situation.

A notable contribution is the announcement of the General Electric Company's plan. Each employee contributes 1 per cent of his monthly salary and the company matches these contributions dollar for dollar. The relief funds will be paid to employees needing assistance. This action speaks well for the cordial relations existing in this company and is part of the broad and constructive policy followed by President Swope in recent years.

Human labor is a necessary asset to a successful business, and the co-operation of executives and employees can be maintained upon such a cordial basis that any emergency of this sort can be handled quickly and sanely. Unemployment is an emergency condition that calls for intelligent and quick action in each large industrial establishment. To cure it is not a governmental function.

Business and government

CONFLICT between the political independence and the economic independence of the individual has underlain the development and decay of all past stages of civilization. It is the basic element in the troubles and turmoils of the present "mechanized" civilization — only, the scenery is new and the stage larger. Peace and happiness result from a reconciliation of these two conceptions.

Between the complete socialization of industry as in Russia and a governmental dictator of industry as in Italy lies a stage wherein a democratic government regulates business that is owned and operated by private individuals. This is the American formula for the adjustment of political and economic independence. The trend in this country is toward the development of very large national business enterprises such as chain stores, railroads, light and power utilities, telephone utilities, chain banks, automotive and steel trusts. As each of these business enterprises becomes large and national in scope it is affected by a public interest and two movements occur. In the one the business begins to regulate itself and in the other government begins to regulate the business. Private ownership and operation with internal business regulation and external political regulation in the public interest is the cardinal principle of the present economic structure of this country.

Can this principle be made to work in a political atmosphere? That is the fundamental question that lies back of the public relations troubles of many large business enterprises. There is no doubt that the public and legislative policies in this country should be made, as they are made, by the mass of citizens and not by the business men. Governmental regulation of business is largely political, the commissions having a political rather than a business character. This situation results from several causes: the inherent antipathy of business to politics, the general suspicion of big business by the citizen, the influence of the political demagogue in gaining votes by denouncing big business, the misconduct of business in some instances, the very great difficulty in getting an

understanding of big business enterprises by the public, and the very great difficulty in getting big business enterprises to understand the psychology of the mass of citizens.

The principle of regulation can be made successful only when it is welcomed by the public and applied intelligently by competent men. The regulators of big business should be business men who work in the public interest under governmental auspices. It should be made possible to have this done because both business and the public will benefit. But there is a long trail ahead to reach this ideal. A business that reaches the regulation stage is so large and so ramified that no one even in the business grasps all its elements —it requires much time and effort to become competent to judge a business by reason of knowing all about its operations. Yet it is hoped that the public can be made to understand, that the regulators can be made to understand and that the politicians can be made to understand. Either this educational job must be done or business must be accepted as a matter of faith like the Bible. Either approach is fraught with difficulty. But action by the public toward reaching an understanding of big business and action by big business toward reaching an understanding of the public are necessary steps to the reconciliation of politics and economics.

Sane comment on water power

THE Federal Power Commission through its chairman, Secretary Wilbur, makes a sane and definite report on water-power development. It states that the control of hydro-electric power is "primarily the responsibility of the individual states" and lays down the principle that projects upon non-navigable streams are clearly under state jurisdiction. It is recommended that a tangible working basis of co-operation be found for those projects that have primarily a state interest and secondarily a federal interest.

In addition to definite statements on policy, the report treats of facts. The commission's dockets are cleared of projects for the immediate development of large hydro plants. Those in view will involve an expenditure of about $70,000,000. Up to the present 2,608,000 horsepower has been placed in service in licensed plants. Only 10 per cent of the 449 licensed projects are east of the Mississippi River. About 80 per cent of the capacity is in four states—Alabama, California, Maryland and New York. A dozen states contain 97 per cent of the total. This should show the local and regional aspect of water power to those who consider it a national issue. It is pointed out that the economy of fuel-burning stations is such that competition between steam and hydro power is becoming keener.

This report and the recent survey completed under the auspices of the United States Chamber of Commerce should make the textbook for those who wish to deal with water power in terms of facts and well-thought-out policies. They "debunk" the subject.

Value of corona loss

AFTER years of familiarity with the presence of energy loss due to the high-voltage corona, it is nevertheless a fact that the amount of loss on a given line and under given atmospheric conditions cannot be confidently predicted within a very wide range of values. The laws of the starting of corona on clean conductors have long since been uncovered by Peek, Whitehead, Ryan and others after them; but the control of starting conditions on transmission conductors and of the increase of loss above the starting point are in little better state than when they were first observed by Mershon at Telluride and Niagara and studied further by Ryan. The trouble is that conductor surface conditions, atmospheric conductivity and the influence of field distribution on space charge travel are so variable that they far outweigh in importance the more definite factors of conductor size and spacing. This incipient corona stage is of great operating importance.

Peek has attempted to incorporate constant factors to account for some of these variables in his loss formulas, but recurring experimental observations have yielded only approximate agreement, predictions of loss values are possible only under the simplest conditions, and wide uncertainty still prevails. The truth is that no thoroughgoing effort to study the influence of conductor surface in relation to humidity and other atmos-

pheric conditions has yet been undertaken. A line is erected, the losses are measured over a range of voltage on one or two standard conductors, the importance of surface conditions is clearly emphasized, but that is about all.

A deeper-reaching study of corona, beginning, for example, in simpler types of conductor surface, is not impossible. But, in view of other obvious difficulties, such a study probably will not be undertaken until there is more definite knowledge as to the importance or non-importance of corona loss. Too high a loss must, of course, be avoided, but many transmission engineers believe that a moderate loss damps out high-voltage disturbances and generally increases stability. There is difference of opinion on the question and it should be cleared up.

Theory indicates such a protective value. It is the amount of this protection that is doubted by some. Transmission engineers should settle this question. If it becomes important to predetermine corona loss, a clean incentive is given for exhaustive experimental study of the conditions governing it. There is little doubt that with such an incentive before them research engineers would respond.

Modernization always in order

IT IS gratifying to note that the proper emphasis upon unemployment problems which featured the sixth New England conference last week at Boston was not allowed to obscure the advantages of modernizing manufacturing plants under favorable cost conditions. In some quarters there is a tendency to look askance at the further mechanization of industry pending resumption of normal employment conditions. This is only another way of trying to justify continued waste of money in inefficient production methods —an economic blind alley of narrow dimensions indeed. This practical suggestion of a study of plant modernization might well be incorporated in the proposed survey under the auspices of the A.S.M.E.

At Boston encouraging recognition of the part modernization plays in stabilizing employment and business conditions was focused in Walter S. Wyman's address on what this policy has done to save certain Maine industries from liquidation. It goes without saying that electrification has helped this work substantially, but the favorable effect modernization has had upon the public welfare and especially upon labor stabilization is perhaps less widely appreciated. It should not be overlooked that modernization and the use of electricity which it inevitably involves contribute through unit-cost reductions to the ultimate development of wider markets and thus to the more lasting prosperity of both manufacturer and consumer. The amazing volume of industrial electrical equipment which has been sold during the past few years in widely dispersed orders shows that manufacturers realize that modernization is a never-failing key to greater efficiency.

Operating experiences point to success of 1,200-pound stations

OFTEN there is a tendency for plant designers, operating men, equipment manufacturers and utility executives to look upon the finding of adverse facts or difficulties in design, operation, tests or management as reflections upon themselves and therefore less worthy of factual presentation and reflective analysis than similar data of a favorable nature. This attitude neglects or overlooks that progressive development depends upon correcting errors as well as building upon successes. To Messrs. Irwin and Gilbert, who this week, at the annual meeting of the American Society of Mechanical Engineers, reported quite fully upon the results of the first few months of operation at their respective Deepwater and Gilbert 1,200-pound stations, special credit is due. They helped greatly in placing the modern high-pressure station in a definite operating status for the industry.

These two pioneer all-high-pressure developments encountered just the sort of difficulties that are to be expected normally in the first applications of new and largely untried principles. They were difficulties of neither a startling nor a particularly serious character, but upon their successful ultimate solution depends in a considerable measure the design and immediate future of similar plants as yet but contemplated. Not only

are Messrs. Irwin and Gilbert entitled to credit for the courage and broad view they display in telling frankly of operating experiences, but to their organizations also praise is due for solving logically and aggressively the difficulties which have so far yielded to persuasion. These pioneers told a story of progress.

There would appear to be a splendid future for pressures at 1,200 pounds or higher as an accepted phase of the art of steam generation, and, together with the binary cycle and a general standardization and simplification of plant design, equipment and housing structures, this should lead rapidly to the approximation of the power engineer's goal of yet lower first cost for each unit of generating capacity and lower unit cost at the station bus for each kilowatt-hour.

The crux of the refrigeration campaign

A NATION-WIDE co-operative campaign to sell electric refrigeration has been announced. It is to start on the first of next March with a three-year program sponsored by the National Electric Light Association and the refrigeration manufacturers. It is to carry the gospel of food preservation to the American home and aims to sell one million refrigerators. The manufacturers are putting up the funds for national promotion. The power companies are asked to appropriate ten cents per residence meter to do the local job.

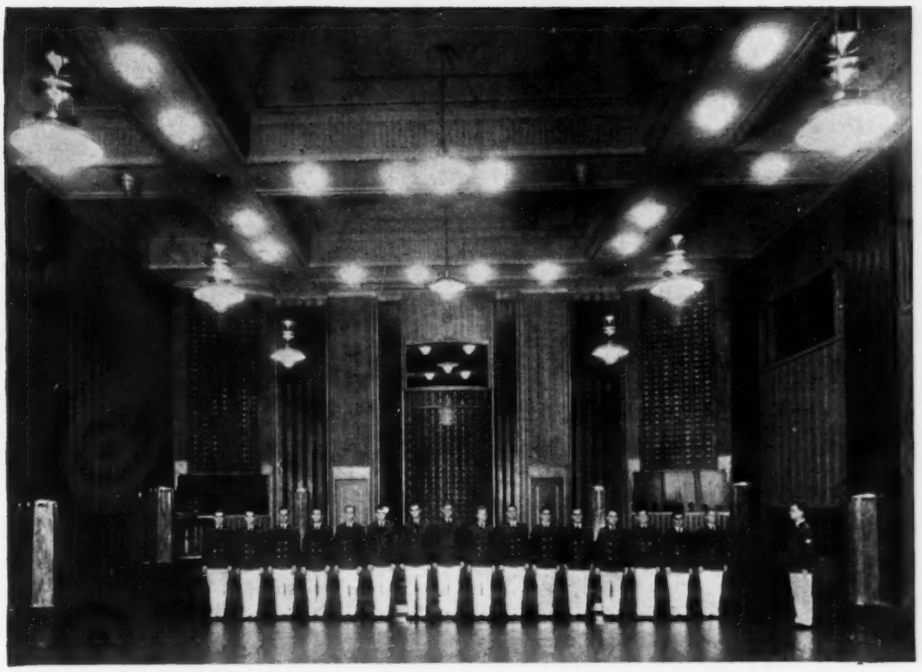
Both for its service to the household and its load value to the utility, electric refrigeration commends itself to the electrical industry as meriting this kind of organized co-operative selling. The equipment has been highly perfected and is thoroughly dependable. It has already developed a large measure of public acceptance. Adequate provisions for easy payment financing have been established to facilitate sales. Its distribution is well set up, with the wholesaler functioning. A large number and variety of dealers are engaged in retailing. Service has been satisfactorily organized. Conditions are right for the development of a more universal use of this appliance. The success of the campaign would seem to hinge upon one thing—the degree to which co-operation is really effected, the extent to which the participants in the campaign are schooled in the parts which they must play.

For it takes more than enthusiasm and money to put across so large a program, more than a prospectus and a plan book. In the end the work is done locally, and by the men of all four branches of the industry. Their class thinking and their sometimes conflicting purposes must be reconciled. Each must be given and must understand both his opportunity and his responsibility, carefully defined. And then his interest must be sustained. Achievement will be measured largely by the thoroughness with which the education and the stimulation of the industry itself is planned and carried out. And the benefit to the individual will depend equally upon his willingness to fit himself into the scheme.

Economical conductor size

RULE-OF-THUMB methods are used very generally in fixing the conductor size for distribution systems and even in many instances for transmission-line extensions. But there is reason to believe that exact economic calculations will pay dividends and help get more kilowatt-hours per unit of system capacity. Copper prices, for example, have fluctuated nearly 100 per cent in the past five years, and these price fluctuations should be reflected in changed engineering standards. With copper prices low and expected to remain at a low level the line losses can be reduced to advantage. These losses are relatively high-rate business and should be capitalized at a maximum value. They also affect the proportion of energy that can be sold at the maximum rate to the customers.

With the development of new types of conductors and changed service standards it is advisable to have keener engineering scrutiny over conductor sizes if the full possibility for investment and operating economies is to be realized. Fluctuating price levels for conductors add to the pressure to replace rule-of-thumb methods with economic analysis for determining conductor size, particularly on distribution systems.



Dual-purpose installation in broadcasting studio. The ultraviolet units are mounted between intersections of the decorative beams. Two are seen dark near the top. The pendant fixtures contain standard "Mazda" units

Artificial Sunlighting Now Challenges the Sun

By M. LUCKIESH

Director Lighting Research Laboratory, General Electric Company, Cleveland

ARTIFICIAL lighting has successfully defended its various challenges to the sun. Natural lighting, at one time supreme even indoors, has gradually been relegated to the background in the indoor world. Artificial light is dependable at all times; it is controllable in quantity, quality and distribution; and it can generally compete with natural lighting indoors in the matter of cost. As a consequence, artificial lighting for vision has risen from the feeble flame era to the commanding position. Now comes a new and final challenge to the sun. Dual-purpose lighting—combining ultraviolet radiation for health with light for vision—has definitely been inaugurated. The foundations* for this new era have been in construction for a long time.

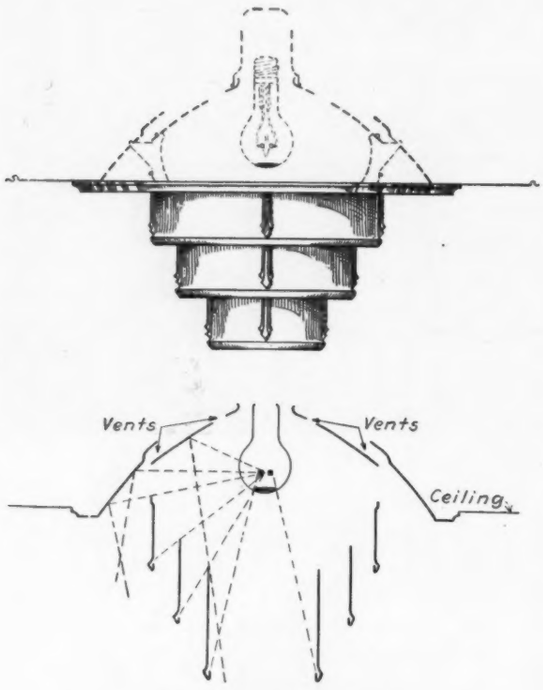
It has long been known that the sun not only supplies light for the eyes but provides ultraviolet radiation of importance to life and health. Although the wave length limits and the relative effectiveness of ultraviolet radiation of various wave lengths have not been thoroughly determined, enough knowledge is available to begin the practice of dual-purpose lighting. At least it is known that energy of wave lengths shorter than λ3200 is valuable in health maintenance. It is also known that energy shorter than λ2800 is particularly harmful to the eyes. Therefore, artificial sunlight must be rich in ultraviolet radiation in the spectral range from λ2800 to λ3200 at least and, of course, must supply satisfactory visible radiation between λ4000 and λ7600.

In dual-purpose lighting we are interested in something more than footcandles. We must know the intensity of biologically important ultraviolet radiation. Furthermore, exposure includes intensity and duration. Erythema or artificial "sunburn" is a guide to exposure limits and the erythemal effectiveness per footcandle must be known. This has been worked out for all the promising sources and filters in the reference given.

Another of the important considerations in the development of artificial sunlight for dual-purpose lighting is the enormous intensity of illumination outdoors during midday in midsummer compared with the erythemal and biological effectiveness. Indoors we must produce the

*"*Artificial Sunlight,*" by M. Luckiesh; D. Van Nostrand Company, New York, 1930.*

desired biological effect with intensities of illumination from artificial sources less than one per cent of midsummer sunlight. In other words, in an hour or more, depending upon the duration of use of the artificial lighting, we must provide as much health-maintaining ultraviolet radiation as accompanies thousands of footcandles of sunlight outdoors over a period of less than one hour.



The ultraviolet unit

The cylinders are of oxidized aluminum. The pool of mercury provides a direct cutoff in conjunction with the cylinders.

A comparison of either erythemal or biological effectiveness of possible dual-purpose illuminants upon a footcandle basis reveals midday midsummer sunlight as a relatively weak source. In fact, from a health-maintaining viewpoint a 500-watt "Mazda" lamp with an ultraviolet-transmitting bulb provides dual-purpose light at least twice as effective per footcandle as the best midsummer sunlight. When we consider the enormous reduction of daylight intensities indoors, the folly of considering the biological benefit of indoor daylight becomes evident. Unless we sit in the direct sunlight, it is useless to consider special glass for daylight openings in buildings. It is even unnecessary to dwell upon the atmospheric absorption in smoky cities or the great loss of beneficial ultraviolet radiation as the sun recedes to low altitudes in the winter months, when we most need health-maintaining radiation.

Practically all experience with ultraviolet radiation has been acquired with high-powered sources and exposures of short duration—usually only a few minutes. Furthermore, most of the applications have been directed toward the cure of illness, which certainly is exclusive territory for the medical profession. Prevention of illness or health maintenance is the territory of every art, science and individual that can contribute toward it. Artificial lighting is in such a position now. However, in artificial lighting the exposure can generally be of long duration. Furthermore, prevention is generally much easier than cure. For these reasons, several years ago we inaugurated experiments which aimed to determine threshold exposures necessary for health maintenance. Much work remains to be done, but surprising results have already been obtained. Space does not permit extensive discussion nor the inclusion of data here. However, it may be stated that artificial sources of light, which were not even considered possibilities a few years ago, are now promising.

Ultraviolet absorption must be combated

Although dual-purpose lighting is bound to develop rapidly at the present time, its introduction into the general scheme of lighting the indoor world involves new considerations which must be met. It is necessary to provide enough ultraviolet radiation and not too much. This is taken care of by adequate factors of safety in the human skin. Health-maintaining daily dosages are sub-erythemal, perhaps as low as 10 per cent of that required to produce a barely perceptible erythema or "sunburn." Several times this exposure causes no known harmful effects. Outdoors, our exposures to sunlight can vary greatly without harmful effects. However, besides this fundamental consideration in dual-lighting practice, ultraviolet radiation must be conserved. Most surfaces absorb the beneficial ultraviolet. Porcelain enamel is quite unsatisfactory, but chromium and aluminum can be used. We find specimens of aluminum vary considerably in their reflection factors for the biologically important radiation. Oxidized aluminum is generally quite efficient. Direct-lighting fixtures can be made for this purpose. Common paints have low reflection factors for the important ultraviolet radiation. Therefore, new paints and other wall coverings must be developed if indirect lighting is to be used in this new era. Our work shows that paints can be greatly improved and that adequate reflecting media will be available. At the present time no transmitting media, excepting quartz, are satisfactory in thicknesses usually necessary for diffusely transmitting media. However, until, they are developed various expedients are available which circumvent the need for them.

Studio given daylight equivalent

An example of this is the fixture we designed for the first noteworthy dual-purpose lighting installation illustrated on page 1035. As seen in the vertical cross-section, on this page, the concentric cylinders of oxidized aluminum screen the source from the eyes. Even when the eyes are directed vertically upward, the pool of mercury in the bulb of the sunlight "Mazda" lamp (S-1) screens the source. Thirty-six of these units, manufactured by Kantack & Company, were installed in the largest Chicago studio of the National Broadcasting Company. They are 26 feet above the floor and are installed on the under side of the decorative beams. For convenience, the necessary transformers are fastened to a rack outside the room and heavy wiring is used. These lamps operate at approximately 30 amp. and 10 volts. The installation was designed to provide an initial intensity of 25 footcandles. This should produce a minimum perceptible erythema upon untanned skin in about

80 minutes. This is produced by midsummer sunlight in about 20 minutes. Therefore, we have in this studio, from which natural light is excluded, a satisfactory equivalent of sunlight. Indeed, such independence is the final challenge to the sun.

Even in this brief glimpse of a new service which artificial light can render to mankind, it is seen that adequate factors of safety and of effectiveness have been provided. Our knowledge of threshold values gained in recent years promises much from weaker sources of ultraviolet radiation. The installation described may be considered not only revolutionary but evolutionary. The artificial sunlight is controlled by a separate circuit. Six ceiling-fixtures containing ordinary "Mazda" lamps provide independent lighting, if desired, and certain other artificial lighting is utilized in a decorative manner. In closing, we commend the progressiveness of the management of the National Broadcasting Company, which installed this first noteworthy example of dual-purpose lighting. New problems were admirably solved by O. B. Hanson, whose co-operation was a primary factor in the eventual realization of this installation.

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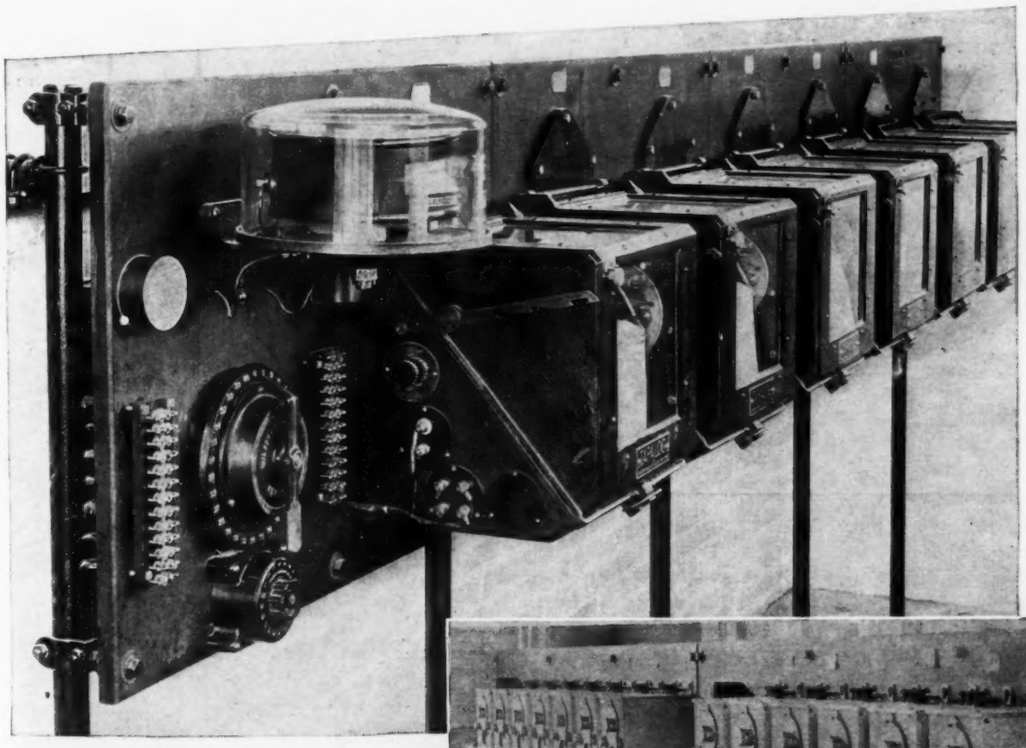
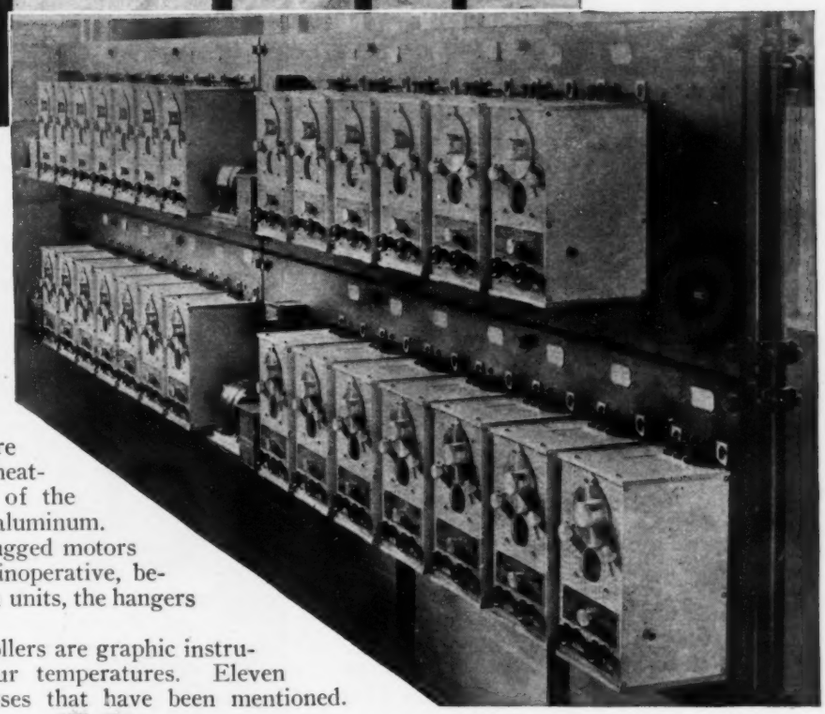
Temperature Regulators and Recorders Aid Production Processes





Flexibility of temperature control has been an outstanding advantage claimed for industrial applications of electric heat and the Massena mill of the Aluminum Company of America has demonstrated by its extensive use of automatic temperature regulators that they have a definite value in controlling quality of product.

For just two uses of electric heat 41 automatic temperature controllers are used, fourteen for as many ingot preheating ovens and 26 for as many zones of the 90-ft. heat-treating oven for structural aluminum. The controllers are gang-operated by rugged motors and easily replaceable, if they become inoperative, because of the separable couplings between units, the hangers and terminal connections.

Used in conjunction with these controllers are graphic instruments, each capable of recording four temperatures. Eleven recorders are used for the two processes that have been mentioned.

Triples Residential Load Despite Cheap Gas

The problem of load building is always of paramount interest to the public utility company, but to the West Texas Utilities Company it was of vital importance to success and development.

Located in West Texas, a vast, virgin empire, with population widely scattered on ranches, farms, small rural communities and small cities, the problem sifted itself down to the fact that electric consumption per residential meter had to be increased.

The principal sources of income in this territory are agriculture, ranching and oil development. Low-price natural gas is available in the majority of the communities served. With these facts in mind, it was necessary to put into effect a rate that would be equitable to large and small home owners, and at the same time be an incentive toward the use of current and the application of electric appliances to domestic tasks.

A rate system was evolved, based on the room-count system, with steps of 12 cents, 9 cents, and 5 cents for 4 kw.-hr. per room on each step. All subsequent service was sold at 3 cents per kilowatt-hour. In addition to this rate, two others were used—refrigeration and heating and cooking. When these rates were put into effect, it was the intention of the company to combine the three into one combination rate at a later date.

Results have proved that a rate of this type is of material assistance in the development of load. In the first place it cut down merchandise sales resistance. The company has always realized that electrical merchandise offers enormous opportunities for the building of load, and to further the sale of these appliances an active merchandise department was organized. During the past five years more than $5,000,000 worth of electrical merchandise has been sold to an average of 30,000 customers, and residential kilowatt-hour consumption has shown a steady increase, from 190 kw.-hr. in 1920 to 580 for 1929.

During this five-year merchandising period 6,264 ranges, 4,322 Frigidaires, 850 water heaters and innumerable other current-consuming devices have been connected to the lines.

It was found that under the old block-type rate results were good up to a certain point, but beyond that it was very hard to build increased load. The low follow-on steps have proved to be the solution to this problem, as shown by the above figures. It is now the intention of the company to consolidate all service on a one-meter basis, which will allow the same advantages as in the separate meter rates and will add many new conveniences. A definite analysis of results on this new rate will not be available until it has been in force over a period of time, but from public and personal comment the new one-meter rate seems destined for immediate public acceptance and success.

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Dual-Purpose Yard Lighting Protects and Guides on Farms

By GEORGE W. KABLE

Director National Rural Electric Project, College Park, Maryland

Well-placed yard lights offer, perhaps, the most appreciated illumination on the farm, serving, as they do, the double purpose of guiding the way from building to building and deterring prowlers from approaching.

Typical of such installations on the National Rural Electric Project, College Park, Md., is that of the H. E. Thompson farm. Here three 150-watt "Mazda" lamps in flat dome enameled steel reflectors have been used. One unit is mounted on the side of the barn above the driveway door, one on the water tank tower and one above the pole in the foreground. The latter is supported directly above the top of the pole by two sections of bent conduit strapped to the pole. This means of support eliminates any shadow from the pole.

Switches to control the yard lights are placed at several convenient points. One of these is at the kitchen door, another is at the barn and a third at the garage. It is also often found desirable to have one inside the house, where it may be quickly operated at any moment.

Adequate yard lighting means safety and convenience on the farm

Power Interchange With Industrial Plants

While nearly 63 per cent of the industrial horsepower in this country that is electrified is operated by purchased power, it has been estimated that about 25,000,000,000 kw.-hr. is generated yearly by industrial private plants. Of this amount the major portion is produced by industries having large quantities of by-product heat or waste fuel to utilize or requiring large amounts of process steam.

What are the possibilities of utilities deriving some benefit from this untouched market? Will they have to consider exchange of energy with such plants on the same basis as utilities; will they have to serve as a clearing house for the surplus heat, waste fuel or steam in the form of electricity; should they supply both steam and electricity, or is joint operation of plants desirable?

Two speakers—B. F. Wood, president of Allied Engineers, Inc., and W. F. Ryan, mechanical engineer Stone & Webster—discussed some phases of this problem at the A.S.M.E. convention this week. Their comments are abstracted here.

STEAM and electric power requirements of an industrial plant seldom coincide, either hourly, daily or seasonal, and these requirements do not, except in a general way, synchronize with the liberation of waste heat. Furthermore, the big power-consuming industries are not always great consumers of process steam and the large steam users are frequently relatively small consumers of power.

To secure the maximum degree of reliability and economy in power service and the fullest utilization of waste heat or surplus power, some arrangement must be made to bring about a massing of the industrial and utility companies' resources.

Among the means that may be employed to secure the advantages of massed resources, B. F. Wood, president of Allied Engineering, Inc., cites the following:

1. The interconnection of the electric circuits securing advantages of protection of service, diversity of load conditions, economy of operation, etc.

2. The establishment of jointly owned plants and facilities, supplying to the industrial plant electric, steam, or other power service, utilizing the utility system as the reservoir from which to draw or into which any and all surplus electric power may be poured.

3. The building and operation of plants and facilities by a utility company near the industrial plant, supplying such power service as required by the industrial plant, making up any deficiency from or taking any surplus electric power on the utility company's power system.

In the first case there are the possibilities of all the advantages of interchange of electric power presented by interconnection between different utility systems, with the further advantage, usually, of a different character and greater degree of diversity of load.

However, it is the two last cases that present the greatest possibility for mutually advantageous arrangement between industrial and utility plants and that make the engineering studies to secure maximum economic results most interesting.

In the establishment of jointly owned plants or the allocation of a portion of the plant facilities to the service of the industrial plant, the total investment may be minimized. Many plant facilities such as real estate, railroad sidings, coal- and ash-handling equipment, etc., need not be duplicated. Spare equipment may serve as spare for both the industrial and utility. The organization for operation and maintenance may be spread over both operations.

A good illustration of the second case, points out Mr. Wood, is the Deepwater station, jointly owned by the American Gas & Electric Company and the United Gas Improvement Company, with a portion of the plant allocated to the services of E. I. du Pont de Nemours & Company. The combined electric-power requirements

of the two utility companies was in the order of some 100,000 kw. demand and 400,000,000 to 600,000,000 kw.-hr. annually, while the industrial company wanted 200,000 to 400,000 lb. per hour of process steam at 180 lb. pressure.

The essential features of the contract between the utility companies and Du Pont company are as follows:

1. The Du Pont company pays in monthly installments a sum representing a reasonable return on the investment in that portion of the plant facilities allocated to its service.

2. It pays the proportionate share of all direct operating and maintenance costs, including fuel.

The Du Pont company is thus entitled to all electric power generated by the steam that passes through its high-pressure turbine unit, and should its need for process steam be in excess of that required to produce the necessary supply of electric power, the excess power flows into the utility system and is credited to the Du Pont company. On the other hand, should its need for electric power at any time exceed the production of the generating unit, power will be drawn from the utility company's system.

The second element of the Du Pont company's monthly charge is determined by the ratio that the total heat supplied to its generating unit bears to the total heat supplied to all generating units. As a result of this arrangement it is given full access to all station-operating records and may even purchase or designate other sources of fuel if it believes lower operating costs would result.

Savings Effected by Combined Plant

Based on heat balances shown in Figs. 1, 2 and 3 and data on page 1042.

	Industrial Plant	Central Station	Total Separate Plants	Combined Plant	Saving Effected by Combined Plant, per Cent
Gross output, kw	6,700	21,500	28,200	27,200	3
Auxiliary power, kw	*1,200*	*1,500*	*2,700*	*2,100*	22
Net output, kw	5,500	20,000	25,500	25,500	.....
Fuel input, million B.t.u. per hour	711	279	990	800	19
Blowdown losses, million B.t.u. per hour	12	4	16	14	13
Other boiler losses, million B.t.u. per hour	105	41	146	105	28
Condenser losses, million B.t.u. per hour	.....	156	156	.....	100
Capital cost of plant (thousand dollars)	$2,168	$2,220	$4,388	$3,928	10
Reduction in capital cost effected by combination					$460,000
Annual saving in fuel cost based on coal at $3.50 per ton of 2,000 lb.					$210,000

The combined full utility and industrial load will require the operation of five boilers, leaving the sixth as spare for all companies. Furthermore, either utility company may, at any time, take any unused capacity of the other, paying only the proportionate operating and maintenance costs. Thus, to the extent that their respective loads do not synchronize, each company has the privilege of fully loading the unused capacity of the other without increasing its share of capital expense. An incentive is thus created that should result in keeping the station as nearly fully loaded at all times as possible. Should this occur, the net effect will be the benefit of all parties, as in this manner the unit station-heat costs will be less because the total cost will be spread over a larger output.

As an example of the third class—that is, of the utility company owning and operating the plant and facilities—may be cited the case of a steel company wishing to change its rolling mills and other steam-engine-driven equipment to electric-motor drive. It was found that sufficient waste gas was available to supply the steel company's electric-power requirements after complete mill electrification. The steel company's electric-power requirement will then be about 300,000,000 kw. annually, with a maximum demand of 54,000 kw. The available waste gas will produce, over and above the steel company's requirements, a surplus of some 40,000,000 kw.-hr. annually. The steel company either would have to install complete spare equipment or relay its electric-power service from the utility company's power system, thus either materially increasing its annual capital charges or adding to its operating charges for reserve or stand-by service.

Utility builds, owns and operates manufacturer's power plant

An industrial company such as the steel company is usually not prepared to make large capital investments, except under pressure of necessity, unless the annual return on capital investment is greatly in excess of that required in the diversified power service of a utility company. This situation led to the suggestion that the utility company build, own, and operate the power plant and facilities, purchasing the waste heat from the steel company at substantially the equivalent cost of other fuel, and furnish the steel company with its entire electric-power requirements on a cost basis to yield a proper return on the investment.

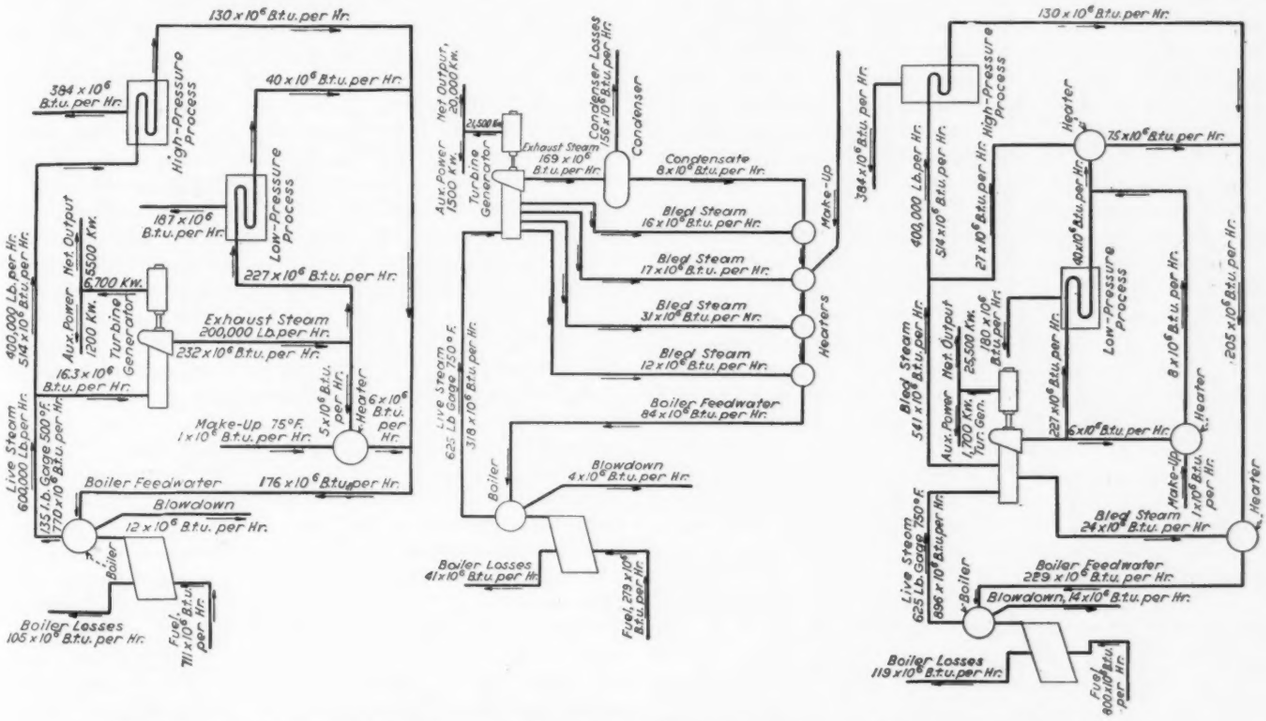
The utility company could build a station designed to operate at 1,400 lb. pressure, instead of 400 lb. as contemplated by the steel company, providing no spare generating equipment. The utility company could relay the steel company's service with the spare equipment required for its other service. Such a plant, in addition to supplying the steel company's requirements, could generate some 100,000,000 kw.-hr. annually at a cost that could advantageously be poured into the utility company's system. The net result will be to furnish the steel company's entire electric-power requirement at a cost comparable with any cost to itself and to save the steel company an investment of something over $6,000,000 in power-station facilities and to increase the annual return on the moneys to be spent by the steel company on its electrification program from about 20 per cent to about 25 per cent.

A case now under consideration is that of a large manufacturer using some 3,000,000,000 lb. of steam per year for process and heating and at the same time buying and generating electric power up to a maximum demand of 42,000 kw. The manufacturer is faced with the necessity of abandoning one of two large boiler plants, and, being thus faced with rehabilitating his steam and power supply, can effect substantial gains by building a high-pressure boiler plant and generating by-product power. Here again even greater over-all results can be obtained by the public utility company building the new plant and serving both the steam and electric-power requirements, primarily because the utility company can make a materially greater use of the investment in plant facilities.

Another case recently under consideration was a group

of stockyard and packing-house companies whose plants are located close together. Their combined maximum demand for steam is almost 2,000,000 lb. an hour, now served from eight relatively low-pressure boiler plants, while they generate or purchase about 130,000,000 kw.-hr. a year. Estimates of a central high-pressure steam station producing byproduct power, including, of course, fixed charges on the new investment, show very substantial economies over the present operating costs. But the point to emphasize is that the over-all saving is a maximum when the public utility company is associated with the new enterprise, as this permits minimizing investment in spare or reserve plant capacity; it permits maximum economical use of all byproduct power; and it supplies, the other hand for furnishing electric power only a portion of the time.

As an example of the possibilities of co-operative steam and power production, W. F. Ryan, mechanical engineer Stone & Webster, considers a relatively large industrial plant, having an average steam demand of 600,000 lb. per hour. Two-thirds of this steam is used at boiler pressure, and the remainder at a lower pressure, after passing through non-condensing turbine-generators. The power demand of the mill, which is only 5,500 kw., is easily and economically supplied in this way. Fig. 1 shows the essential features of the plant heat balance, with heat flows given to the nearest million of heat units, above 32 deg. F.


130 x 10⁶ B.t.u. per Hr.
384 x 10⁶ B.t.u. per Hr.
High-Pressure Process
40 x 10⁶ B.t.u. per Hr.
187 x 10⁶ B.t.u. per Hr.
Low-Pressure Process
227 x 10⁶ B.t.u. per Hr.
Net Output 5,500 Kw.
6,700 Kw.
Aux. Power 1200 Kw.
Turbine Generator
400,000 Lb. per Hr. 514 x 10⁶ B.t.u. per Hr.
Exhaust Steam 200,000 Lb. per Hr.
232 x 10⁶ B.t.u. per Hr.
16.3 x 10⁶ B.t.u. per Hr.
5 x 10⁶ B.t.u. per Hr.
6 x 10⁶ B.t.u. per Hr.
Heater
Make-Up 75°F. 1 x 10⁶ B.t.u. per Hr.
Live Steam 600,000 Lb. per Hr. 135 Lb. Gage 500°F. 770 x 10⁶ B.t.u. per Hr.
Boiler Feedwater
176 x 10⁶ B.t.u. per Hr.
Blowdown 12 x 10⁶ B.t.u. per Hr.
Boiler
Boiler Losses 105 x 10⁶ B.t.u. per Hr.
Fuel 711 x 10⁶ B.t.u. per Hr.
Net Output 25,500 Kw.
Aux. Power 1500 Kw.
Turbine Generator
Exhaust Steam 169 x 10⁶ B.t.u. per Hr.
Condenser Losses 356 x 10⁶ B.t.u. per Hr.
Condenser
Condensate 8 x 10⁶ B.t.u. per Hr.
Make-Up
Bled Steam 16 x 10⁶ B.t.u. per Hr.
Bled Steam 17 x 10⁶ B.t.u. per Hr.
Bled Steam 31 x 10⁶ B.t.u. per Hr.
Bled Steam 12 x 10⁶ B.t.u. per Hr.
Heaters
Boiler Feedwater 84 x 10⁶ B.t.u. per Hr.
Live Steam 625 Lb. Gage 750°F. 378 x 10⁶ B.t.u. per Hr.
Boiler
Blowdown 4 x 10⁶ B.t.u. per Hr.
Boiler Losses 41 x 10⁶ B.t.u. per Hr.
Fuel 279 x 10⁶ B.t.u. per Hr.
384 x 10⁶ B.t.u. per Hr.
408,000 Lb. per Hr. 514 x 10⁶ B.t.u. per Hr.
High-Pressure Process
Heater
75 x 10⁶ B.t.u. per Hr.
27 x 10⁶ B.t.u. per Hr.
40 x 10⁶ B.t.u. per Hr.
Low-Pressure Process
8 x 10⁶ B.t.u. per Hr.
205 x 10⁶ B.t.u. per Hr.
Bled Steam 541 x 10⁶ B.t.u. per Hr.
Net Output 25,500 Kw.
Aux. Power 1,700 Kw. Tur. Gen.
180 x 10⁶ B.t.u. per Hr.
227 x 10⁶ B.t.u. per Hr.
6 x 10⁶ B.t.u. per Hr.
Heater
Make-Up 1 x 10⁶ B.t.u. per Hr.
Heater
Bled Steam 24 x 10⁶ B.t.u. per Hr.
Live Steam 625 Lb. Gage 750°F. 896 x 10⁶ B.t.u. per Hr.
Boiler
Boiler Feedwater 229 x 10⁶ B.t.u. per Hr.
Blowdown, 14 x 10⁶ B.t.u. per Hr.
Boiler Losses 119 x 10⁶ B.t.u. per Hr.
Fuel 800 x 10⁶ B.t.u. per Hr.

Figs. 1, 2 and 3—Heat balance of isolated industrial plant, condensing central station and combined central station and industrial plant

in the most economical manner, electric power which at times is required in quantities greater than is available from the steam then used.

In principle, declares Mr. Wood, the industrial should pay the power company a reasonable rate of return on all investments made on its account and also pay its proper share of all operating costs. If byproduct power from steam be involved, then the combined unit cost of saving both steam and electric power is a minimum when the investment in steam capacity is fully utilized and when the electric-power requirement is just that of the byproduct power available from this amount of steam. Any unbalanced conditions from this exact relation between the quantity of steam and of electric power will increase the combined unit cost. Hence, the unit rates for each should bear some relation to the quantity of the other, and in the limit be equitable on the one hand for furnishing steam only a portion of the time and on

The territory in which this plant is situated is served by a central station, which is also highly efficient. The essential features of its heat balance are outlined in Fig. 2.

Fig. 3 shows the economies that can be effected by combining the functions of these two power stations in a single plant, producing the same quantities of steam for process and the same net output of electric energy. Instead of the total heat consumption of 990,000,000 B.t.u. per hour required for the two individual plants, we have a heat consumption in the combined plant of only 800,000,000 B.t.u. per hour, a saving of 19 per cent. Had we assumed a more efficient central station, with higher initial pressure, reheat, and additional stages of feedwater heating, the fuel saving would have been proportionately greater.

The above fuel saving is based on the ideal condition illustrated in Fig. 1, where the demand for exhaust steam

is precisely equal to the supply. This never occurs in practice. Either there is an excess of exhaust steam which is blown to the atmosphere or concealed by wasteful application in process, or there is a deficiency of exhaust steam, and live steam is supplied through a reducing valve. In one case there is a total loss of valuable heat, in the other a degradation of energy and loss of potential power. Under any practical conditions, therefore, the saving should be greater than that indicated by these heat-balance diagrams.

Many industrial boiler plants are operated in whole or in part on waste fuel. If 50 per cent of the heat supplied to the boilers in Fig. 1 is waste fuel, and this waste is utilized in the combined plant of Fig. 3, then the saving in purchased fuel is 30 per cent.

Analysis of the more important wastes in these heat balances shows that the fuel saving in the combined plant is effected by a 22 per cent decrease in auxiliary power consumption (largely due to elimination of condenser auxiliaries), 13 per cent reduction in blowdown losses, 28 per cent reduction in other boiler losses, and 100 per cent elimination of condenser losses. Reduction of radiation, leakage, friction, generator losses, etc., not taken into account on these diagrams, should offset, in large part, the transmission losses incident to the combination.

Under favorable circumstances, the cost of a combined steam and power plant of this kind will cost less than two separate plants for the two functions. If the combination involves transmission of power or steam over great distances, or if the loss of steam in process necessitates the installation of expensive evaporators, the case may be reversed, but there are obvious savings in the elimination of condensers and circulating-water supply, and the reduction in the number of boilers and other items of equipment. These savings are not offset by the greater amount of high-pressure piping and equipment. For the particular case under discussion, the capital cost is estimated as follows:

Cost of complete industrial power plant, in accordance with Fig. 1, including land, auxiliary structures, etc	$2,168,000
Increment cost, for capacity assumed in Fig. 2, for large central station, including land, auxiliary structures, etc	2,220 000
Total cost, separate plants	$4,388,000
Complete cost, combined plant, in accordance with Fig. 3, including land, auxiliary structures, etc	3,928,00
Saving effected by combination	$460,000

If the combination plant is so situated that it can supply steam and power to several contiguous industries, then the cost of such a plant might be taken on an increment basis, as well as the central station. The same applies if an existing central station is so situated that it can supply one or more industrial plants without duplicating existing coal-handling facilities and the like. Both of these cases result in a great reduction of initial cost, and also operating labor and maintenance costs.

There is a deep-seated and well-founded reluctance on both sides to invade what, up to now, they have each considered the domain of the other. However, our electric-power companies have neglected few opportunities to extend their service or to reduce their costs. Our manufacturers have been equally diligent in reducing production costs. These heat units, and the dollars they represent, will not be allowed to roll into the atmosphere and into the ocean forever.

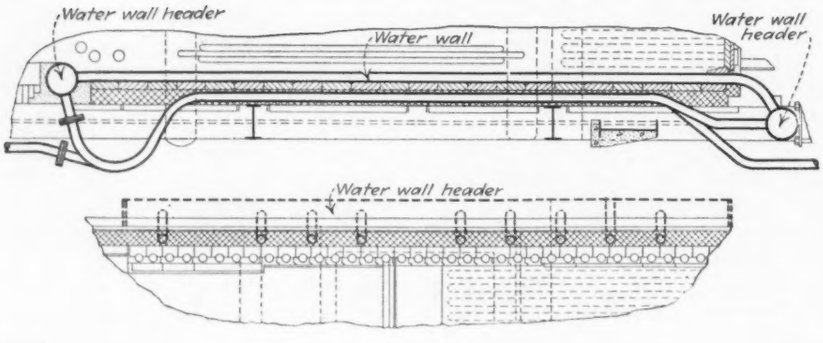
The first requirement for the success of such a co-operative enterprise is that the advantages must be equitably divided between the two parties. If the plant is owned and operated by the manufacturer, the utility must be assured of the continuity of the power supply. If, on the other hand, the utility owns and operates the plant, the manufacturer must be assured of the reliability of his steam supply. If a plant is built under joint ownership, there must be a just division of costs between the two services. All three of these plans are in use in this country today. All require mutual confidence, good engineering, and intelligent management, and each party must have a sympathetic understanding of the problems of the other.

Another field in which public utilities and the industries may profitably co-operate is in the better utilization of waste fuel. There are some industrial plants which can supply their entire heat and power requirements with combustible waste from their manufacturing operations. To improve the efficiency of power generation or heat utilization in such plants would only create an unmarketable surplus of waste fuel. If surplus power could be sold at a figure advantageous to both producer and purchaser, then it would pay to use efficient apparatus and prevent unnecessary waste.

The pioneering is now being done by the more enterprising managements, and we may look for a rapid and widespread development of co-operation between public utilities and the large steam-using industries.

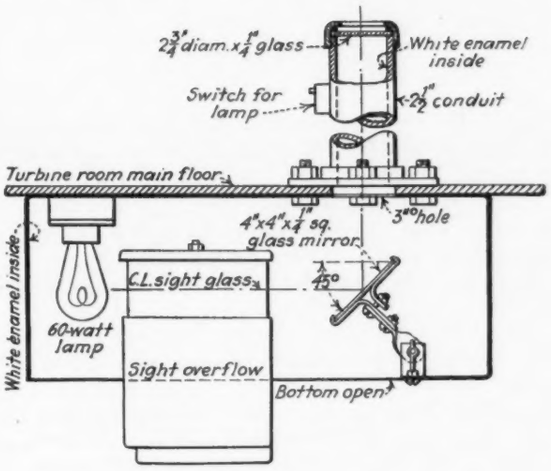
▼ ▼ ▼

Reducing Boiler Insulation



Heat insulation is an important item of expense in boiler costs. With the introduction of water walls this item increases because the pipes connecting the boiler drums and the water wall headers have to be covered. Then, as is shown by these vertical and horizontal sections of a boiler wall in the Horseshoe Lake station of the Oklahoma Gas & Electric Company, a thought was engendered in the mechanical division of the Byllesby Engineering & Management Corporation, "Why not imbed these pipes in the wall insulation?" The result is a very worth-while reduction in the cost of insulating and the side of the boiler looks a lot less snaky.

Sub-Floor Overflow Gage Made Visible by Mirror



In order that the turbine-oil sight overflow located below the turbine room floor may be within easy sight of the machine attendant modification of the periscope has been installed in the Coos Bay steam station of the Mountain States Power Company. It consists merely of an open bottom box, white enameled inside, covering the overflow sight glass and containing a mirror and lamp. The periscope tube is a 3-ft. piece of 2½-in conduit, on which is mounted the switch for the light in the box.

Three-Phase Transformer Unit Improves Distribution

By F. W. L. HILL

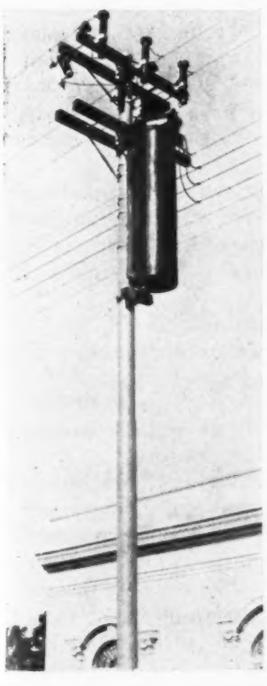
Engineering Department, Electric Bond & Share Company, New York

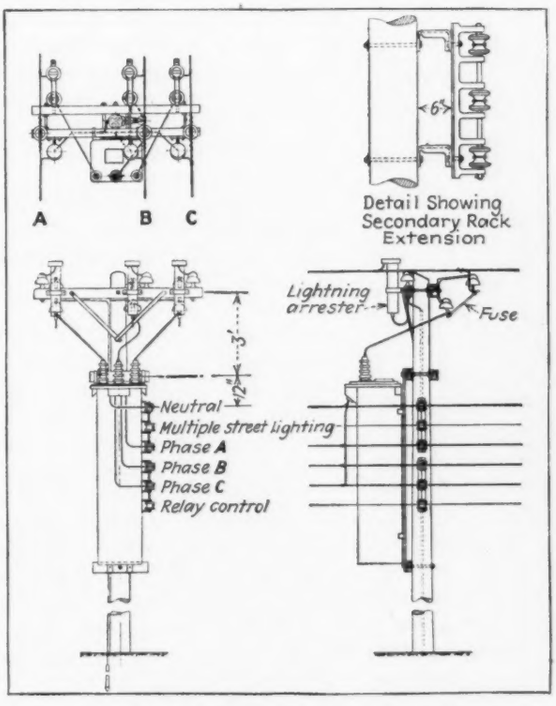
In order to simplify construction, reduce hazards and generally improve the appearance of three-phase transformer installations on city streets or alleys, a three-phase vertical type of distribution transformer with cover bushings, in sizes 30, 45 and 75 kva., has recently been developed with the particular aim of adaptability for use on narrow streets. This type of transformer consists of three standard single-phase cores clamped together, one above the other, and mounted in a single tank having a relatively small diameter.

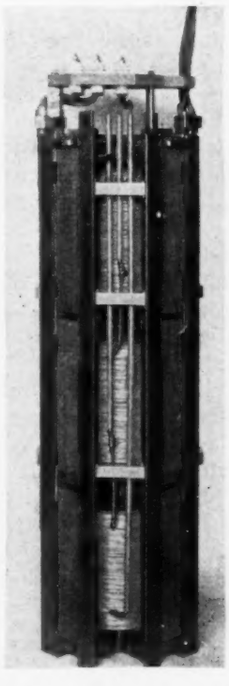
Among the advantages of this type of three-phase transformer, when compared with the installation of three standard single-phase units or one standard three-phase unit with pocket-type bushings, are: Minimum lateral space requirement, better distribution of weight on the pole, and the complete separation of primary and secondary conductors due to the use of cover-type bushings and neat appearance.

It will be noted that the secondary circuits, if carried on vertical racks, can be installed on a level with and to one side of the transformer case by using short extension brackets, thus conserving pole height.

In case of burn-out on one phase, the corresponding core can be replaced with a standard single-phase unit without disassembling the windings of the other two cores.







Left — Typical installation of a 45-kva. unit on a 35-ft. tubular steel pole connected 13,200 volts on the primary side and 120 / 208 Y, three - phase, four-wire on the secondary. Center — Racked secondaries further improve distribution line appearances. Right—Core and coils of a General Electric Company three-phase, vertical-type transformer, high-voltage side.

Vertical-type three-phase distribution transformer has many advantages

Deepwater and Gilbert 1,200-Lb. S

GILBERT

(*See* ELECTRICAL WORLD, *March 2, 1929, page 429*)

One General Electric 55,000-kw. compound turbine consisting of a high- and low-pressure cross-compound installation, the low-pressure section working at variable pressures. The high-pressure turbine has a multi-valve arrangement in order to obtain high efficiency over a large load range.

Steam pressure, 1,250 lb. gage, 750 deg. F., exhausted through steam and gas reheaters at a pressure varying from 400 lb. gage to 85 lb. gage, the steam being reheated to 750 deg. F. before entering the low-pressure turbine.

Two boiler units, each designed for 250,000 lb. of steam per hour, are of the cross-drum type, eight tubes high.

Furnaces are water-cooled, except around the circular burners, where refractories are used. The side walls of both furnaces and the front and rear walls of No. 1 furnace are of fin-tube construction. On No. 2 boiler the front and rear walls are of the bare-tube type, backed up by refractories. The furnace volume is 18,000 cu.ft. and the B.t.u. release about 18,000 B.t.u. per cubic-foot maximum.

Omission of the wall between the boiler and turbine rooms enables the station operator to see and control all principal equipment. With the exception of the coal-handling and milling machinery all apparatus is under the control of the station operator and can be governed automatically or by push-button devices. The control and operation of the plant on one floor, without any wall between turbine and boiler room, has made the Gilbert plant simpler to operate than existing low-pressure plants and it has been found that no added personnel or higher class labor than is used in low-pressure plants is needed.

Operating Experiences

WITH a plant radically new in design and with many untried features it is evident that some difficulties would be encountered and would have to be rectified. Operating difficulties reported upon should not be considered as a reflection on the effort or service of the manufacturers connected with this station.

While the plant has not attained the normal expected output, sufficient information is available regarding operating costs and fixed charges to indicate the economical justification of the design and construction.

Piping—During the early period of operation composition gaskets used on the high-pressure lines in sizes of 2 in. and under gave trouble and were replaced by metal gaskets, which have been entirely satisfactory. It was found that when the flanges on the high-pressure superheated lines were covered leaks developed during the change of temperature periods when a line was being brought up to pressure or the pressure was being lowered. Removal of the flange covering overcame this.

Turbines—Minor trouble was experienced in the beginning on the high-pressure turbine due to condensed steam from the glands getting into the oil system. There has been considerable trouble due to sticking of the valve stems in their bushings and in the cam mechanism of the valve control, and alterations have been made to obtain even changes of load. Leakage in the horizontal joints of the high-pressure turbine was stopped by tightening the holding-down bolts. On the low-pressure unit trouble developed with the vacuum tripper, which was due to faulty adjustment. No difficulties have been experienced with the intercepting valve, but changes are being made to give a more rigid construction.

Condensers—Leakage between the rubber expansion joint and the water box, causing the loss of the circulating system, has been overcome by a change made in the bolting arrangement. Some trouble was experienced with the reciprocating air pump during starting due to pulling water from the water seal between the first stage jet and the condenser into the cylinder, which caused cracking of the head. This has been corrected by the installation of a bypass around the first stage jets, which is used during starting up.

Boiler Feed—The secondary feed pumps were originally provided with Ryan seals; now replaced by a combination labyrinth and stuffing box which has proved satisfactory. A Mercon regulator is being installed between the primary and secondary feed pumps to insure bottling up of high-temperature water in the secondary pump during light-load operation.

Superheater—The superheat obtained at the start was low, but this has been adjusted by the installation of a kicker baffle.

Gas Reheater—Reheat temperature was entirely too high during the first period of operation [illegible]ed the use of a desuperheater. To remed[illegible]uble reheat surface has been removed from both boiler units.

Steam Reheater—This reheater has not been used regularly as the gas reheater has given more than enough temperature, and the use of the steam reheater has not been required.

Economizers—The first trouble on the economizers was due to leaky handhole caps, this having been remedied by using softer steel gaskets. Later considerable trouble developed in leaks between the tubes and the headers.

Induced Draft Fan—At the starting period difficulties were experienced, caused by erosion of the fan-inlet vanes, due to the high velocity when the vanes were almost entirely closed at light ratings. This trouble has been overcome by the installation of leak-in dampers which are used at light loads during starting.

Burners—With the original installation of the burners the flame went below the slag screen and changes were made to remedy this. Trouble has been experienced with the burning of the cone and alterations are being made to overcome this difficulty. It has been impossible to operate continuously burning the mill vents in the boiler, due to the fact that the vent fan does not have sufficient excess pressure to operate satisfactorily with the high secondary air pressure required by the first design of the burners.

Stations Report Upon Performance

Slag Trouble—In the beginning slag trouble was experienced due to faulty burner operation and the impossibility of removing excess slag during operation where the slag screens cross. Changes in burner design and the installation of additional doors in the ashpit have overcome this trouble.

Emergency Boiler-Feed Pump—A turbine-driven emergency boiler-feed pump was installed, all other auxiliaries being motor-driven. This pump has functioned when trouble had developed with the main turbine, and its use has been felt to be justified.

Feedwater—During the first months of operation the water did not cause any difficulties, but during the extreme dry season the amount of solids in the water increased very rapidly. The evaporator had to work at its full capacity due to excessive leakage of the economizer, which also aggravated the feedwater difficulties and raised the concentration in the evaporator and boilers, causing solids to be carried over with the steam into the turbine, where they deposited and reduced the efficiency and capacity of the unit. Greater care is now being taken to keep down the concentration in the evaporation, and with this precaution it is expected that no further difficulties with the turbine being filled with scale will be experienced.

AS pioneer plants designed for high-pressure steam exclusively, the Deepwater station, of the American Gas & Electric and the United Gas Improvement companies, and Gilbert station, formerly Holland, of W. S. Barstow & Company, and now of New Jersey Power & Light Company, have been looked to eagerly by engineers for performance data and operating experiences.

At the annual meeting of the American Society of Mechanical Engineers, held in New York this week, K. M. Irwin of the United Gas Improvement Company and E. M. Gilbert of W. S. Barstow & Company reported the results presented in abstract here.

DEEPWATER

(*See* ELECTRICAL WORLD, *May 11, 1929, page 919*)

Two General Electric 53-58,000-kw. compound turbines and one high-pressure turbine duplicating high-pressure end of other units.

Six boilers, two supplying each high-pressure machine. One of each pair of boilers is equipped with a reheater and small size economizer, while the other has no reheater, but a large-surface steaming-type economizer.

All boilers have air heaters, those on the reheater boilers having 14 per cent larger surface than those on the boilers with steaming economizers.

Boilers are designed for 1,350-lb. pressure and turbines for 1,200 lb. The initial temperature admitted to the high-pressure cylinder is 725 deg. F and at the exhaust to the high-pressure cylinder the steam is reheated in the flue-gas reheaters to 750 deg. F.

Operating Experiences

DEFINITE figures on the economies obtained or on the operating efficiencies of the equipment were not available at the time that the report was prepared, as commercial operation had been in effect but a little over three months. Many difficulties such as are encountered in new plants, and especially those of novel design features, have come up, for some of which remedies have been provided and others are still to be treated.

There have been no difficulties in the boiler room traceable to 1,200-lb. pressure. Many of the fears of 1,200 lb. have been centered around the piping. To date there have been no leaks on the larger sizes of high-pressure piping, which is equipped with the Sarlun joints. The economizers, which have been subjected to as high as 1,800 lb. pressure, are the B. & W. return-bend type with copper gasket joints. In general, these have been satisfactory, in that only one of the boilers has been troublesome with leaks, and on this boiler it was found that most of the leaks were attributable to the gaskets being improperly installed or that the faces had not been properly prepared to receive the gasket. Generally, the same observation was applicable to the water-wall tubes. Some of the boilers developed a number of leaks, but in nearly all cases after these had been rerolled no further difficulty was then experienced. In a few cases where there has been a repetition of the difficulty it was found to be traceable to the fact that the water from the quenching of the slag-tap system had slopped over on these tubes before the covering was completed.

Other difficulties encountered in the boiler room, foreign to the pressure or temperature, have been the slag-tap furnace bottoms, boiler side and rear walls, and the pulverized-fuel system. Boilers which are taken off the line and put back at fairly frequent intervals

have their furnace floors grow and push the side walls out. This is due to having the bottoms crack in cooling down and the cracks and interstices fill with molten slag when the boilers are heated up. The repetition of this operation gradually pushes the walls out, so that it is necessary to cut back the furnace bottoms adjacent to the side walls and to allow the walls to spring back or to be pushed back into shape and start over again.

Upon discovering the difficulty that arose in connection with the pushing out of side walls the owners of the Deepwater plant, after two of the boilers had been installed with dolomite bottoms similar to other installations, had the next two boilers changed with mica schist used in place of dolomite. Subsequent experience indicated that at Deepwater the dolomite bottom was much superior to the mica schist. To date there have been only two cases of leakage of slag from the furnace bottoms covered with dolomite. Neither of these was serious, and both were immediately stopped by chilling the slag leak with water, and after the furnace was shut down, cutting back the floor approximately 6 in. along the two sides, allowing the walls to assume their normal position, filling again with silica sand and dolomite.

The last two boilers were designed with bottoms of radically different design, and coke cans were placed on top of 5 in. of silica sand, and above this additional coke and coking coal were spread in order to form a solid coke bottom. It has been found that these last two boilers with their coke bottoms have been the least satisfactory of any of those installed. The slag contains a large amount of iron sulphide, which, due to its weight, sinks to the bottom of the slag bath and is therefore never drawn out through the slag tap. This material is very heavy, penetrating down through the coke and entirely consuming it, so that on one boiler with this design of bottom it has been found that all remnants of the cans of coke entirely disappeared. It has now been decided to reconstruct with magnesite the two furnaces which originally had the coke bottoms.

The side walls are made up of bare plain tubes backed up with refractory material. It has been found that the rear wall—that is, the wall opposite the burners—is subject to severe slag erosion, and it has been necessary to replace three of these walls. Combinations of the particular ash of the fuel that is being burned, with various compositions of refractory, are being investigated in an attempt to obtain a refractory that is not so susceptible to slag erosion.

There is no marked improvement in the flexibility of the bin system over a direct-fired system for normal operation. The bin system does have the distinct advantage of being able to cut the boilers down to very low ratings. The direct-fired system has a distinct low-rating limitation.

The direct-fired end of the plant presents a much more desirable appearance, in that the pulverized bins of the bin system are bulky and cut off considerable light and air, so that a visitor to the plant is much more favorably impressed by the general arrangement at the direct-fired system end. The one counter-balancing feature, however, has been the more reliable operating condition existing at the bin end of the plant. On a number of occasions it has been necessary to cut back the load which the plant was carrying, due to failure of coal supply to furnaces from the direct-fired system. A number of these interruptions were caused by small adjustments which were needed on the mills themselves. One of the difficulties with these three mills is that in normal operation they are extremely quiet and do not become noisy even when the coal feed fails, as is the case with the other mills.

Some difficulty has been experienced with the coal

Typical Average Operating Data (Gilbert Station)

Date and time	August 19, 1930, 2:30 p.m.	
Station load:		
Kilowatt gross	52,000	
Boiler No.	1	2
1,000 lb. steam per hour	218	218
Steam pressure, lb. per sq.in.	1,265	1,265
Steam temperature out of superheater, deg. F.	770.0	754.7
Steam temperature in reheater, deg. F.	543.5	543.5
Steam temperature out of reheater, deg. F.	808.6	818.8
Steam pressure in reheater, lb. per sq.in.	415.0	415.0
Steam pressure out of reheater, lb. per sq.in.	410.0	410.0
Economizer:		
Gas temperature in economizer, deg. F.	935.0	937.2
Gas temperature out of economizer, deg. F.	550.0	557.6
Water temperature in economizer, deg. F.	363.0	365.0
Water temperature out of economizer, deg. F.	505.0	494.4
Air Preheater:		
Gas temperature in preheater, deg. F.	550.0	557.6
Gas temperature out of preheater, deg. F.	312.0	308.3
Air temperature in preheater, deg. F.	85.0	85.0
Air temperature out of preheater (left), deg. F.	410.0	405.0
Air temperature out of preheater (right), deg. F.	420.0	412.6
Flue-gas Analysis:		
CO_2 in economizer, per cent	13.13	13.53
Condenser:		
Barometer, in Hg	29.86	.....
Vacuum, in Hg	28.20	.....
Circulating-water temperature, in deg. F.	73	.....
Evaporator:		
Make-up water, lb. per hour	7,200	
Make-up water temperature, deg. F.	70	

Performance by Weeks (Gilbert Station)

Week Ending		Gross Generated Lb. of Steam	Maximum per Hour as of Steam	Plant Service, Hours	Station Load Factor, per Cent	Ratio of Station Use to Net Output	B.t.u. per Net Kw.-Hr.
March	1	203,000	7,000	56	2.20	.....	15,553
	8	42,000	5,000	13	0.45	.....	15,553
	15	186,000	11,000	25	2.01	.....	15,553
	22	1,833,000	27,000	93	19.84	11.05	15,553
	29	2,920,000	28,000	126	31.60	9.77	15,553
April	5	1,510,000	23,000	70½	16.34	12.48	13,091
	12	2,351,000	23,000	113	25.44	10.92	12,872
	19	2,782,000	35,000	119½	30.11	9.51	13,008
	26	3,819,000	51,000	137½	41.33	8.47	12,637
May	3	5,095,000	56,000	138	55.14	6.95	12,476
	10	3,710,000	30,000	145½	40.15	9.23	12,344
	17	3,118,000	26,000	125	33.74	8.93	13,844
	24	3,308,000	30,000	148	35.80	8.79	13,014
	31	3,926,000	30,000	168	42.49	9.61	13,345
June	7	4,187,000	33,000	168	45.31	9.51	13,454
	14	4,360,000	34,000	168	47.19	10.32	13,463
	21	3,946,000	32,000	155	42.71	9.88	12,894
	28	277,000	Out of service for repair on turbines, condenser, reheaters and economizers				
July	5						
	12	4,223,000	33,000	143	45.70	9.05	12,716
	19	4,899,000	42,000	149	53.01	8.41	13,786
	26	6,319,000	53,000	144	68.39	7.50	11,866
Aug.	2	6,337,000	54,000	126	68.58	8.17	12,652
	9	7,344,000	56,000	149	63.35	7.15	12,798
	16	8,030,000	54,000	168	86.90	7.53	12,977
	23	7,342,000	54,000	168	79.46	8.24	12,420
	30	3,429,000	37,000	144	37.11	11.74	13,594

hanging up in the raw-coal bunkers and sticking in the connections between the raw-coal bunkers and the scales which are installed between the raw-coal bunkers and the mills, jamming in the scales or in the magnetic separators and catching small particles of wood or foreign material on the feeders of the mills themselves.

It is safer and more comfortable to have a small supply of powdered coal on hand in order to take care of unforeseen difficulties which may happen in the fuel-supply system which will be absolutely no fault of the particular mill which is being used, and in the Deepwater plant ten hours' supply of powdered coal is probably far more than is necessary. The recommendation would be that a two or three hours' supply would make an ideal practice.

Turbine Room Difficulty—Difficulty has been experienced in the turbine room with silica scale deposited on the last rows of blading and nozzles in the high-pressure turbine which is used in the Du Pont system. To date no evidence of scale has been found in the other two high-pressure units. It has been necessary to shut this machine down for periods of two weeks in order to scrape the scale off the nozzles and blading by hand. This has been a laborious and expensive job. In order to correct this condition, purifiers have been installed on the vapor outlets of the house evaporators to cut down the carry-over silicate in the make-up water. Since these have been installed the purity of the vapor in the evaporators has been considerably increased and the turbine has operated for a period of several weeks without showing any symptoms of scaling. Similar difficulty has been experienced at other plants, and it has been found that the scale can be taken off the blades by admitting water to the steam in the high-pressure throttle to the extent of having the steam in a completely saturated condition. After operating for several hours under this condition, it is found that the scale can be entirely washed off, so that while it is felt that this difficulty has been overcome at Deepwater, it is comforting to know that if a repetition of this should occur a remedy has been found. This is one of the troubles which can be directly charged against the pressure that is utilized in this plant, as the other plants which have experienced this trouble are also operating at 1,200 lb.

Considerable difficulty has been encountered with the governor mechanism and control valves on the high-pressure turbines. The manufacturers have made certain changes, and it is now felt that this problem has been overcome.

"So far as I am concerned I shall not again try to change the Maine law prohibiting hydro power export. I am sure that the people of Maine are suffering losses and losing benefits which they might have gained had they repealed this act and been willing to come into the United States on a power citizenship basis, so to speak . . . ."

W. S. WYMAN,

President New England Public Service Company, before the sixth New England Conference.

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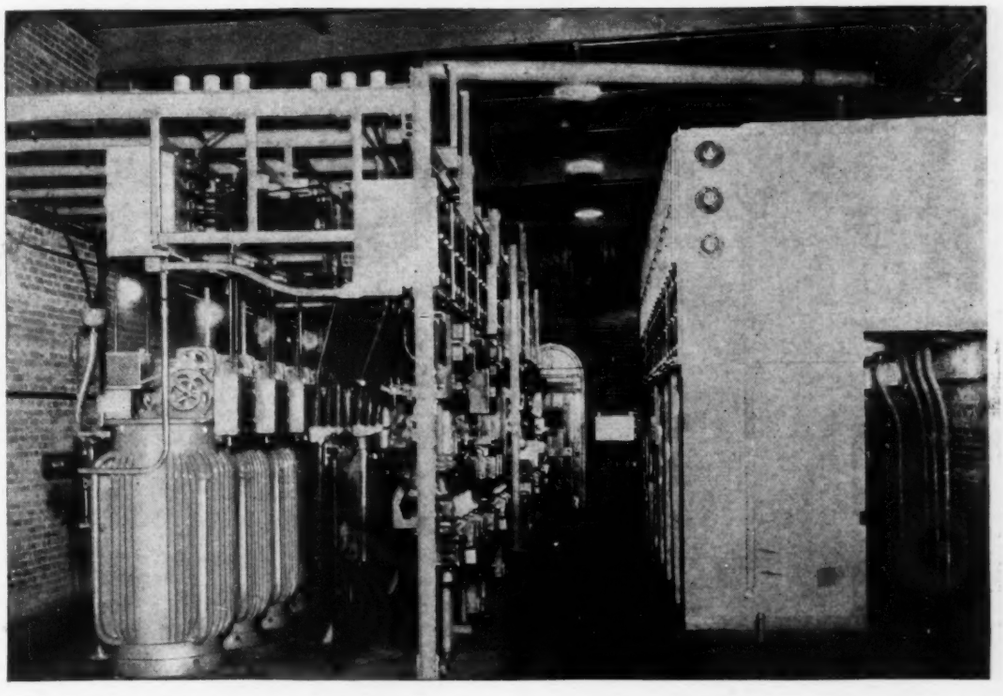
Conduit Simplifies Bus Feed



The usual way to run substation transformer leads back to the distribution bus is to spread them and carry them over in open construction. A considerable saving over this method is accomplished in the remotely controlled substation of the Commonwealth Edison Company, Chicago, by running the leads in a short length of 6-in. conduit, as shown.

The Power Customer's Stake

By K. D. HAMILTON

Head of Mechanical Department,
Geo. E. Keith Company, Brockton, Mass.

ON THE surface the problems of industrial substation design, location and equipment do not appear to be of more than passing interest to the power customer of the central-station organization, but in reality the manufacturer who buys electricity through such an installation is vitally concerned in its engineering, its costs and its relation to his particular distribution system. Indeed, he is justified in being very exacting in this connection. The power company is, of course, interested in industrial substation engineering from the points of view of ownership and operation, and where both parties to the power contract work together in providing a mutually satisfactory installation the foundation is laid for enduring service and good relations.

In the long run, the customer pays the bills, and frequently there are special arrangements where the ownership is divided between the customer and the power company, where it may be on a rental basis, or where the customer assumes part of the first cost of the equipment.

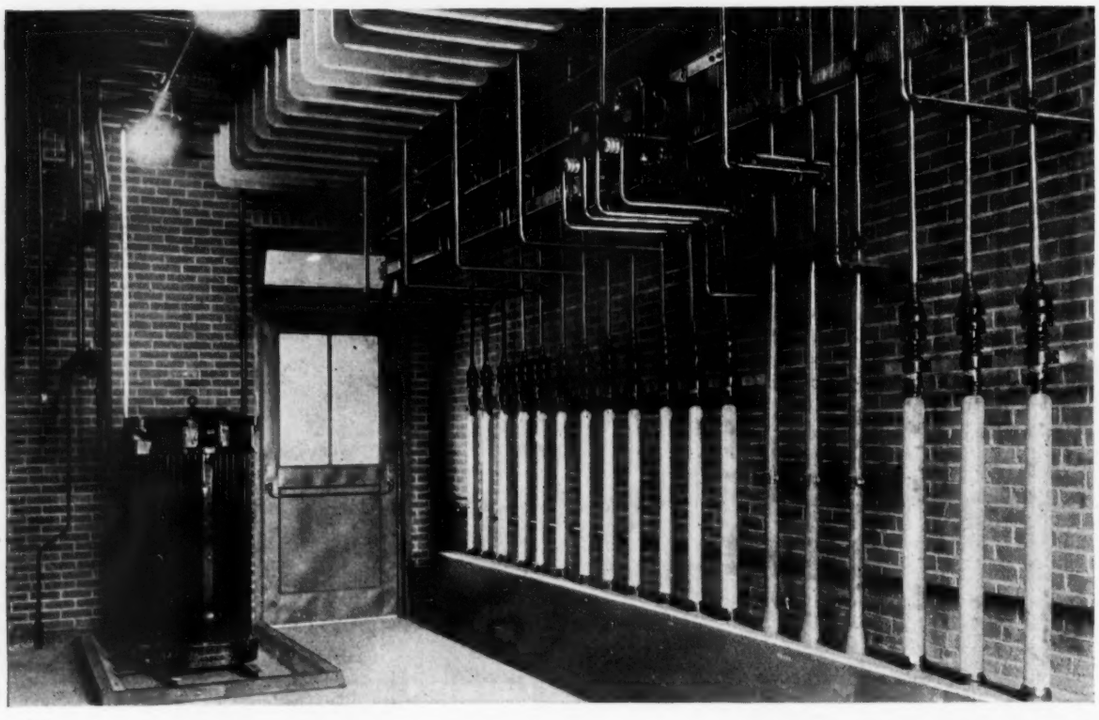
Such questions as property rights, overhead charges, capacity for future extension, interest charges, all have an effect on the ultimate power rate to the customer, which, of course, is reflected in his production cost, depending upon the amount of power consumed.

Let the various points which may be of vital interest to the customer be considered one by one.

First is the location. Substations vary in size from two or three transformers mounted on a pole to other designs of larger outdoor units placed on substantial concrete foundations and inclosed with a wood or wire fence. Others consist of an elaborate structure of brick or concrete in which are included various types of power apparatus such as meters, transformers, switches, lightning arresters, condensers, rotary converters and other expensive electrical apparatus.

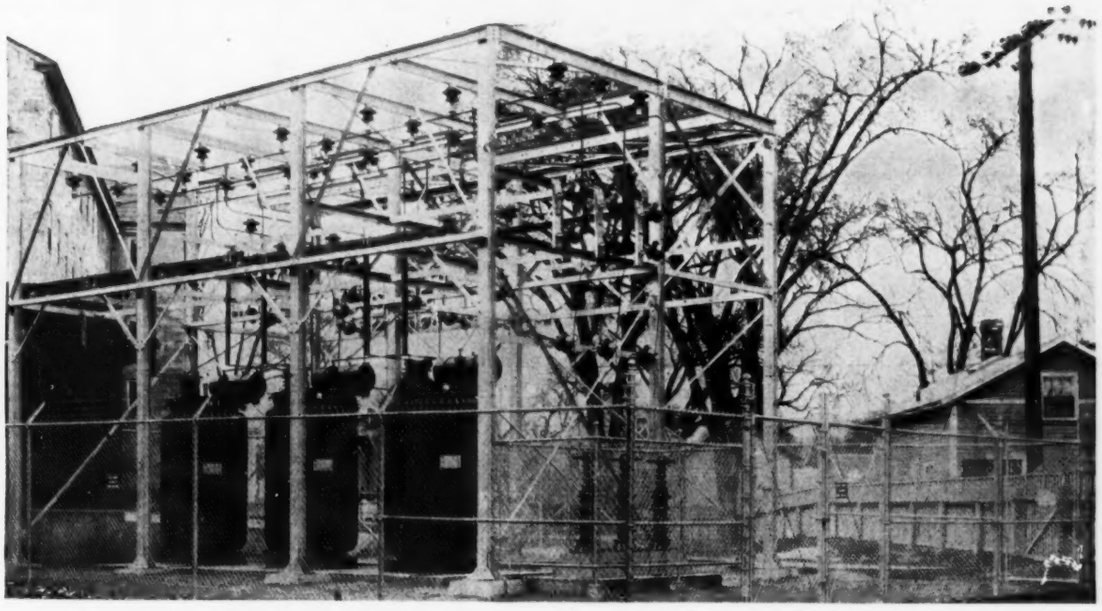
Short-range service to major equipment

Regardless of the design of the station or its size, its location is of paramount importance to the customer. It should be as near to the center of distribution of power load as possible. This reduces transmission losses and thus, of course, favorably affects voltage drop and the cost of power lines to and from the factory.



Symmetrical wiring and permanent construction assure the best service

in the Industrial Substation



Modern outdoor industrial substation design.

Accessibility as related to operation of all parts of the equipment should be easily attained without undue wastage of labor when emergency conditions develop. The question of fire prevention and the nearness of the substation to other fire hazards is one of vital importance; the substation should be isolated as much as possible, but still be near enough to the major equipment to furnish short-range service.

The permanency of construction is also an item in which the customer is interested. We have many times seen outside transformer work installed in such condition that the foundations were not adequate nor the overhead wiring of sufficient rigidity to withstand heavy storms or snow loads. Some substations are built near an old boiler or power house where the engine equipment has been removed for one reason or another. These permanent buildings or foundations for transformer banks are best located near the old switchboard from which distribution to the factories is controlled. This furnishes the ideal arrangement.

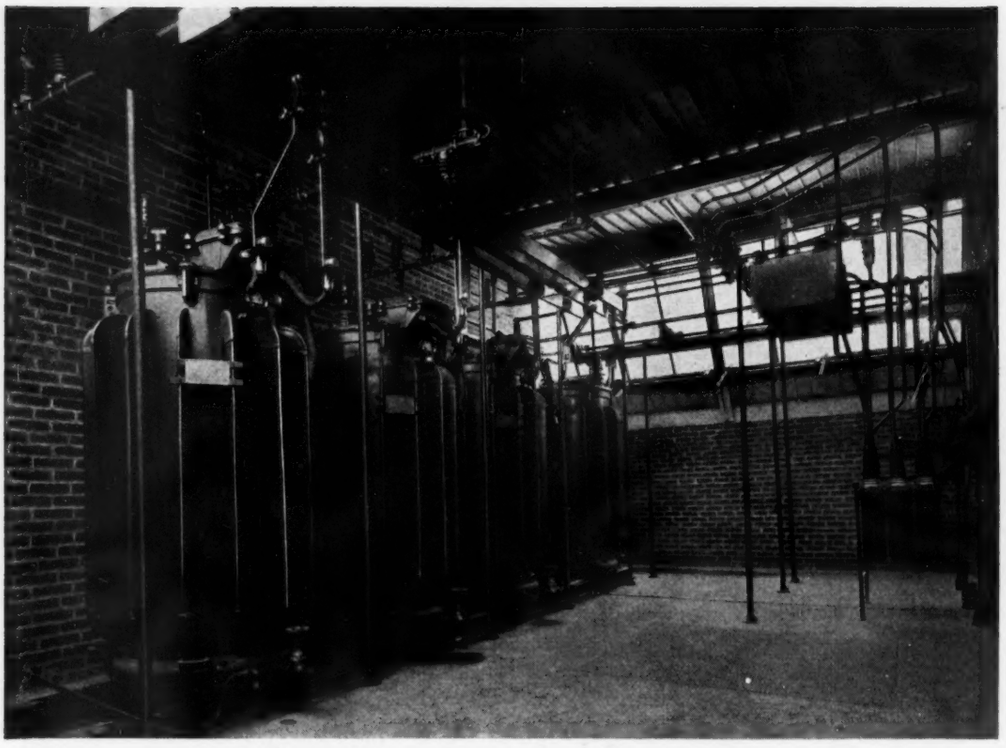
THE VALUE of greater co-operation between power purchasers and utilities in laying out and equipping substations is set forth as well worth while in the interest of improved service and closer control of investment and operating costs as they affect both parties to power contracts.

The design of the installation is also of great importance to the customer, whether it be a pole job, a concrete foundation for transformers or an expensive substation. The first thing to decide is the size of the equipment to be installed, taking care that there is sufficient overload capacity to prevent excessive voltage drop and still allow for reasonable future growth. Additional space should be provided when building permanent structures or foundations so that there will be room for a duplicate set of transformers or other power apparatus in case the customer's requirements increase with future business.

The problem of primary voltage will, of course, depend entirely on the power company's transmission lines, and the customer naturally has little to say about the pressure delivered to the transforming equipment. He does, however, have considerable interest in the secondary voltage and the location of the meters which record the amount of energy consumed.

Some contracts are so planned that the meters record primary power, but in most cases the secondary service is metered by the power company. In either case the transformer loss is usually absorbed by the customer in the rate, depending upon where the meter is placed.

Oil drainage from transformers is an item which should be considered, especially on private property of the customer. It is frequently necessary to change the oil in these transformers after a period of years of use, and for this reason such units should not be installed in or near buildings where there may be a possibility of fire or where the use of an inflammable liquid may ignite oil seepage or other drainage from the substation structure.



Liberal spacing and use of daylight in this factory substation make operation easier and safer

The actual design of the structure or building will depend primarily upon whether the building or equipment is located in the city boundaries or out in the country. Building regulations and insurance laws must be observed. Protection from intruders is an important item, and protection from lightning or other causes of service intrruption is of vital importance to the customer. Care must be taken also in the design of the foundations for the support of heavy equipment to be sure that the bearing pressure of the soil is of sufficient capacity to withstand the heavy load.

The writer has known of instances where the exterior design of an elaborate substation was made to harmonize with the architectural features of the nearby buildings. This request came from the owners of these buildings, who did not care to see the construction become a detriment to the local surroundings.

The customer,of course, has to be guided materially by the judgment of the power company in the problem of selecting equipment. There are a few requirements, however, which he must insist upon. First is the problem of rating or overload capacity. Often the power company's desire to keep its overhead charges at a minimum lead it to install transformers of minimum size. It frequently becomes necessary to increase capacity at additional expense in the future and this item should be carefully analyzed before definite purchases are made.

Switch control is of vital importance. The writer has known of cases where it has been necessary to disconnect the transformer lines on account of fire hazards developing in the factory. Permanent switching apparatus is necessary even on the smallest job. Accessibility by the customer is advisable, especially for larger units which may be kept locked by the power company. It is advisable to provide this access by giving the head electrician keys to the substation, so that in case of emergency he can pull switches or perform other operations, in this manner saving the time which might be lost in sending messages to the power company's office.

The important feature of permanent service and reliability is one which must have serious consideration regardless of the type of equipment installed. Any interruption or breakdown in power lines has a far reaching effect on production problems. The variation in losses due to interruption will depend entirely on the nature of the business involved, but, regardless of the size of the factory, there have been many avoidable losses in the past. The writer has known of cases, especially in drying operations, where interruptions of service have damaged the entire day's production because certain goods were left in driers for a longer period than was necessary. The operating equipment, motors and fans would not function because of the interruption.

Regular checks of reliability factors

Careful inspection by the customer as well as the power company helps to prevent such breakdowns. This problem of reliability is most important and can only be solved by constantly checking the capacity of the load in the customer's factory to see that the transformer or other distribution equipment is of sufficient capacity to carry the load. The writer has known of cases where transformer coils have "let go," fuses on switchboards have been overloaded, and where the switches themselves have burned out. These conditions might have been safeguarded and eliminated by adequate inspection and by testing the customer's lines to see that his load was not increasing too rapidly.

Industrial power loads vary from time to time and from season to season. The design should, for that reason, be carefully worked out to take maximum requirements. This particularly refers to switchboard apparatus, meters, wire sizes and transformers.

The problem of future growth is more or less of a "gamble," but the outcome can be frequently anticipated by study of the nature of the business.

The effect of poor design in the substation is reflected

in the operation of the motors on the factory machines as well as the voltage on lighting services and heating units. It is comparatively simple to alter the size of an outdoor substation, but with the erection of a permanent building the problem is more difficult, because of the expense involved in foundations and superstructure.

Customers are vitally interested in having all substation equipment inspected regularly to insure continuity of service. This applies particularly to meters, fuses, transformers and converters.

The meters are of particular interest from the point of view of accuracy in insuring correct bills when the charges are made each month. Smaller transformers are constantly giving trouble owing to overloading of fuses or possible poor contact, which may cause overheating and breakdown.

There are many losses in transmission of power through the various systems of distribution in which the customer has a vital interest. The power factor will vary with the loaded conditions of the motors on the line as well as the efficiency of the system as a whole.

Voltage drop and copper losses, however, have a direct bearing on the operation of the substation. Voltage drop affects lighting system and heating units as well as the speed of motors, particularly on variable-speed equipment used in printing plants and machine-shop practice.

The power company's volume of night and day load also affects the voltage, especially if the substation is on the end of a long transmission line such as might serve a factory in the country. The writer has known of variations of 20 volts on the 550-volt side of a transformer between the day load and the night load. This was due to the fact that the load was largely that due to motor-driven industrial machines. The voltage dropped, because of motor requirements, when the day load was on. The lighting equipment was designed for a secondary 110-volt system, and when the motor load was thrown off the lighting voltage ran up in some cases as high as 128 to 130 volts. This condition made it necessary to use a high-voltage lamp, especially in the power house and in places where illumination was required after the factory working hours. This illustrates a case where voltage drop was very important, especially after regular working hours. We have had to buy special high-voltage lamps to meet these conditions in order to obtain reasonably long life and satisfactory wattage.

Liberal use of instruments commended

Meters form one of the most important phases of substation requirements and are of vital importance to the factory. The customer should insist on a kilowatt indicating meter to give the actual power requirements at any moment during the day. Ammeters and voltmeters are necessary to check the operating conditions. A power-factor instrument should be installed, if possible, to give the complete record, in order that the customer may be in a position to improve intelligently conditions in his power service and obtain as low a rate as possible, especially if a power-factor clause is operative as a part of the contract. A curve-drawing demand meter is of great importance and assistance in checking the peak loads in the factory. It is possible to cut down the capacity charge on most individual plants by a careful study of the demand meter. The foremen in a factory will very frequently throw the motors on the line at a time when the demand is greatest. This creates a peak condition which determines the capacity charge for that particular month. All motors should be placed in service gradually rather than throwing them on the line at once. In this way one can in many instances reduce the demand charge, which in the course of a year may amount to many hundreds of dollars.

This simple discussion should emphasize the fact that the customer is just as vitallly interested in his substation requirements as the power company. It is safe to say that there is not sufficient co-ordination between the average power company and its customers from this point of view. Each customer or prospective buyer should go over these details carefully with the power company before signing his contract and not take too much for granted.

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What We Expect in College Men

By BANCROFT GHERARDI
Vice-President and Chief Engineer
American Telephone & Telegraph Company, New York

Bell System employs 14,000 college graduates and adds about 1,500 yearly.

One-third of all its supervisory positions are filled by college men.

These are divided, roughly, as 55 per cent technical, 35 per cent arts and sciences and 10 per cent from business courses.

Electrical communication industries want men who can recognize the problems with which they are confronted and who can study the problems, determine the appropriate action and then take such action in the right way.

Understanding of the problem needs perception. There can be but little perception without broad knowledge of the business, as things must be seen in proper relation to each other and to the business as a whole. There must be imagination, intelligence, judgment, intellectual honesty, and high aims.

Study of the problem and the determination of the action to be taken require courage or the will to do. They require an active type of courage—the willingness, even the eagerness, to face difficulties, both difficulties of a physical nature and opposition from others. The determination of action, which often involves personnel questions, requires a sense of justice. The effective

**Excerpts from "What the Electrical Communication Industries Expect of the Technical Schools" as presented by Mr. Gherardi at the recent dedication of the James Ward Packard Laboratory at Lehigh University.*

carrying out of action involves skill in persuading and in meeting difficulties.

To the above, I would add only a few additional characteristics—good health, a sympathetic understanding of people and of the world at large and an ability to carry on several projects simultaneously without becoming overwhelmed or confused.

Tact is admittedly helpful in getting things done and in making life pleasant for all concerned. It is a desirable characteristic for men in administrative work. Men wholly lacking in tact are not likely to be completely successful. However, overemphasis of tact may result in the selection of colorless individuals and those lacking force.

Skill in the judgment of people is essential, but in general it goes with the other characteristics outlined. To be able to select good men, train them and give them opportunities for advancement are, of course, essentials.

Telephone engineering is one of the specialties into which engineering has been differentiated, and while ordinarily considered a subdivision of electrical engineering, in fact, it invades many of the other fields of engineering, notably the mechanical field. I do not feel that the school training of a man for communication engineering should be essentially different from that given to electrical and mechanical engineers in general.

It seems that the important thing is that the engineering student have discipline in the methods of solving engineering problems and a general foundation in mathematics, physics and materials which will enable him to solve the special problems that come before him by getting the facts and then interpreting and reasoning from them correctly.

In electricity, the student's work should be carried further than in other branches of physics, and he should have a thorough working knowledge of both direct and alternating currents. In addition to giving this knowledge in abstract form, it should be taught in some of its principal applications. Laboratory experimental work is valuable, but should, it seems to me, be carried on primarily as illustrating fundamental laws and so as to give the student the manual dexterity needed in handling electrical instruments. The time devoted to this work may be divided between the different branches of electrical engineering, and certain fundamental problems with reference to the telephone and telegraph should not be excluded.

One of my strongest convictions is that unusual effort may well be made to teach every engineering student to speak and to write a report or letter in clear, convincing English, setting forth the facts and arguments and conclusions pertaining to the question before him. Also, it has always seemed to me that a knowledge of at least one foreign language is desirable, perhaps more so than ever now that the export business and foreign activities of this country have become so great.

Correct engineering is the determination of the most economical way of arriving at a desired result. I can appreciate the difficulties of emphasizing this point of view in a college education, but whatever can be done along these lines will be helpful.

I do not think that it is possible to overemphasize the importance of accuracy, as errors due to carelessness are as serious as those due to incorrect mental processes, as far as practical results are concerned.

In presenting my ideas on this matter, I have tried not to be dogmatic. I recognize that it is for the educators to determine how results in education shall be accomplished, while, on the other hand, it is the duty as well as the privilege of those in industry to outline what they need.

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To keep the public fully informed of the manifold uses of electricity is the prime function undertaken by The Electrical League

WHEN YOU WANT TO KNOW . . .

- What services any electrical appliance can perform
- How to use an appliance
- Who manufactures any type of appliance and where it is sold
- Where you can have an appliance repaired

Ask The Electrical League

WHEN YOU WANT TO KNOW . . .

- How to plan the wiring for a new house, store or other building
- How to extend and improve wiring in an existing building
- How to get new devices and equipment connected to a wiring system
- Who are the established wiring contractors

Ask The Electrical League

WHEN YOU WANT TO KNOW . . .

- How to install proper lighting in a new house, store or other building
- How to modernize the lighting in an existing house or other building
- What types of lighting fixtures will serve your requirements best
- Who are the established lighting fixture manufacturers and dealers

Ask The Electrical League

AND WHEN YOU WANT TO . . .

- See the newest models of electrical appliances
- Study and compare refrigerators, washers, ironers, cleaners and any of the other appliances
- Ask questions about these, and have your questions answered impartially
- Have demonstrations of appliances
- See modern, scientific, artistic lighting equipment
- Select Electrical Gifts for any occasion
- Obtain authoritative literature on the applications of electricity
- See a fully electrified kitchen
- Have lighting plans checked
- Obtain the answer to any question pertaining to standard practice in the use of electricity

Come to The Electrical League

Prospective customers who don't know where to go to get fixtures, wiring, estimates or to apply for service! Consumers who don't know how to go about buying heavy-duty appliances or providing for wiring and installation! Users who don't know the full possibilities of the equipment they now own! There are undoubtedly many of them in every community.

Why not advertise the availability of electrical facts and make sure that the information can be supplied. Electric utility companies could well afford to assume the leadership in such a movement. Here is an Electrical League suggestion to accomplish further familiarity by the public with electric service facts.

Currents Required to Remove Conductor "Sleet"

By J. E. CLEM

Central Station Engineering Department,
General Electric Company, Schenectady, N. Y.

THE storm which causes the most damage is the "ice storm," although it is popularly called a sleet storm. After a period of freezing weather, during which the temperature of the ground and exposed surfaces has been reduced below freezing, the air at some distance above may rise to a temperature above freezing, while the air near the ground remains at or slightly below the freezing temperature. Should precipitation occur it will pass through the warm air as rain and become frozen upon striking the cold surfaces of the ground, or trees, or wires and adhere to them. Should the air near the ground be too cold the rain will freeze while falling and not stick to the exposed surfaces, and is then "sleet."

The thickness and shape of the deposit on the conductor depend upon the storm conditions. If there is not much wind the ice will gather on the top side of the conductor and build up in an approximately circular shape with the conductor imbedded in the bottom hemisphere. When there is a wind the formation is generally on the lee side, the deposit buiding up in a more or less elliptical or egg shape with the conductor near the small end. Ice deposits an inch in diameter have been observed on wires as small as No. 12, and a little more than an inch thick on conductors about No. 4 in size. Mixtures of ice and snow have been observed about $1\frac{1}{2}$x$3\frac{1}{2}$ in. on a No. 9 wire, $2\frac{1}{2}$x$3\frac{1}{2}$ in. on a No. 4 and $1\frac{3}{4}$x6 in. on a No. 1/0 aluminum cable, all with the long axis in the direction of the wind. The surface, however, was very rough, so that the wind pressure is probably higher for a given velocity and normal section than on a conductor. From the available records it appears that the ice storm usually occurs when the wind velocity is fairly low and that the temperature drops and the wind velocity increases after the storm. When a mixture of ice, or sleet, and snow is deposited on the conductor the wind velocity is higher.

Preventing the formation of ice

As previously mentioned, ice forms on conductors over a relatively short range of air temperature, probably between —3 deg. C. and +2 deg. C., and then only on cold objects, the temperature of which is already below freezing. To prevent ice from forming on the conductors all that is required is to heat them to a temperature slightly above the upper temperature limit of ice formation.

Heat is dissipated from conductors in air by two methods, radiation and convection. When the conductors are subjected to wind the heat loss by convection is considerably greater than that by radiation. Conductors

subject to ice formation are invariably in the wind, so that the convection loss is predominant. The following formula, modified from one given by Schurig and Frick in the *General Electric Review* for March, 1930, gives the temperature rise of the surface of a conductor suspended in air, when the wind velocity is above 2 miles per hour.

$$\theta = 175\, w_c \sqrt{\frac{d}{v}} = 8.18\, \frac{R}{\sqrt{dv}}\, I^2\, 10^{-4} \qquad (1)$$

$$w_c = 4.67\, \frac{R}{d}\, I^2\, 10^{-6} \text{ at 0 deg. C.} \qquad (2)$$

θ = temperature rise above surrounding air, degrees C.
I = current in conductor.
w_c = watts per square inch of surface of conductor.
R = resistance of conductor, ohms per mile at 20 deg. C.
d = diameter of conductor in inches.
v = velocity of wind crosswise of conductor, miles per hour.

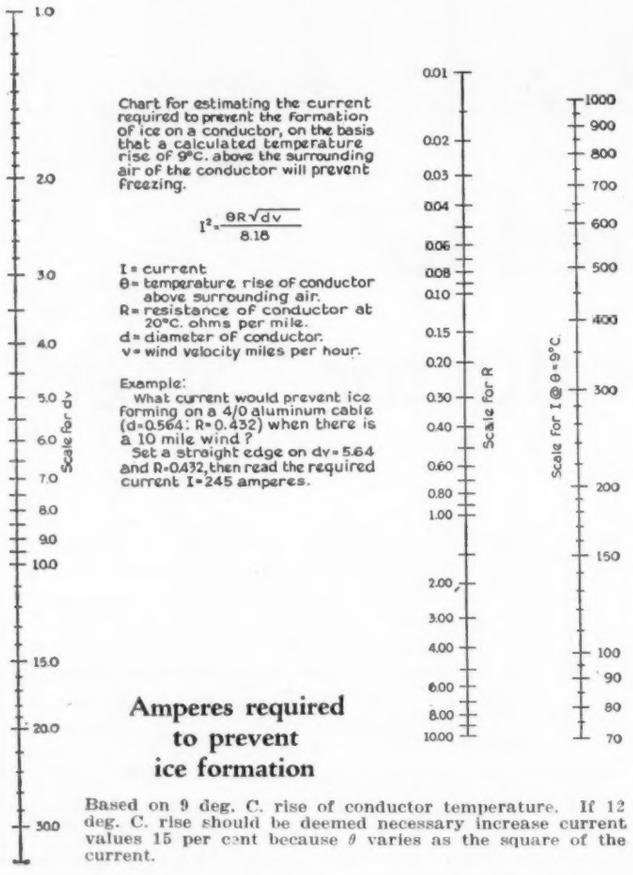


Chart for estimating the current required to prevent the formation of ice on a conductor, on the basis that a calculated temperature rise of 9°C. above the surrounding air of the conductor will prevent freezing.
$I^2 = \frac{\theta R\sqrt{dv}}{8.18}$
I = current
θ = temperature rise of conductor above surrounding air.
R = resistance of conductor at 20°C. ohms per mile.
d = diameter of conductor.
v = wind velocity miles per hour.
Example:
What current would prevent ice forming on a 4/0 aluminum cable (d=0.564; R=0.432) when there is a 10 mile wind?
Set a straight edge on dv=5.64 and R=0.432, then read the required current I=245 amperes.
Scale for dv
Scale for R
Scale for I @ θ=9°C.
Amperes required to prevent ice formation

Based on 9 deg. C. rise of conductor temperature. If 12 deg. C. rise should be deemed necessary increase current values 15 per cent because θ varies as the square of the current.

In this expression the temperature of the surrounding air is taken as 0 deg. C. and an allowance has been made for the watts per square inch given off through direct radiation.

It appears from available information that the wind velocities when ice is forming are relatively low. During one very severe storm in the Northwest the recorded wind velocities were between 8 and 9 miles per hour.

In Tables I and II are shown some data previously published, together with the temperature rise calculated by using the formula just given. It appears that a temperature rise of 9 deg. C. is sufficient to prevent the formation of ice, and this seems to be reasonable. If the air is at —3 deg. C. a temperature rise of 9 deg. C. would give a conductor temperature of +6 deg. C. and

Table I—Current Required to Prevent Sleet Adherence

Tests made in open air at a temperature slightly below freezing and with wind velocity between 1 and 5 miles per hour.

Size Wire, No.	Amperes	Calculated* Temperature Rise Degrees C.	Watts per Square In.
0000	225	8.6	0.158
000	200	9.1	0.132
00	175	9.4	0.144
0	150	9.2	0.149
3†	100	9.8	0.19
0 Al †	120	9.3	0.146
300,000 Al ‡	250	11.6	0.132

Tests from H. H. Sener, *Electric Railway Journal*, June 17, 1922.
*Temperature rise calculated from formula No. 1 and based on a wind of 3 miles per hour.
†L. W. Wyss, ELECTRICAL WORLD, September 5, 1925.
‡ ELECTRICAL WORLD, April 27, 1918, page 879.

*Table II—Temperature Required to Prevent Sleet Adherence**

Tests made on 477,000-circ.mil, nineteen-strand aluminum cable. Temperature rise corrected to a basis 300 amp.

Temperature Rise, Degrees C. Calc.	Test	Wind Air Miles per Hour	Air Temperature, Degrees C	Ice Adherence	
10.3	7.6	1.8	—3.3	No	(1)
8.3	3.3	3.6	—0.2	No	(2)
6.2	5.2	6.4	—8.7	Yes	(3)
5.4	6.5	...	+13	No	(4)

(1) Artificial rain at an air temperature of 0 deg. C.
(2) Natural rain with a little sleet which melted when it struck conductor.
(3) Artificial rain.
(4) Wind not recorded, but given as high. Calculated temperature rise based on a wind velocity of 10 miles per hour.
* R. L. Thomas, ELECTRICAL WORLD, March 10, 1917.

*Table III—Current and Time Required to Melt Ice**

Tests made at 23 deg. F.

Conductor, Size	Current, Amp.	Watts, Sq.In.	Time to Melt, Minutes	Calculated Time ½-In. Ice	½-In. Ice
0 Cu	300	0.613	20	17.4	33.8
2 Cu	280	1.083	10	8.8	17.1
3 Cu	250	1.223	10	7.7	15.1
0 Al	225	0.513	20	21.8	42.8

Tests were made by spraying water on a conductor to form the ice and the time given is that required to melt it off. Wind velocity not given and assumed as 3 miles per hour for calculating the time. Thickness of ice not given.
*L. W. Wyss, ELECTRICAL WORLD, September 5, 1925.

the raindrops falling upon the conductor would, no doubt, lower the temperature somewhat. The first four values given in the tabulation were obtained in a set of tests. The last three were obtained from operating experience, with nothing mentioned about the wind velocity, though it was probably in excess of 5 miles per hour. The data in Table II are not as conclusive because the actual values of current and temperature rise were not given, but instead values as converted to a basis of 300 amp. However, it is noted from the table that when the calculated temperature of the cable was raised to about 7 deg. C. (tests 1 and 2) ice did not form, and that it did when the temperature was left below 0 deg. C. (test 3).

It appears to be entirely feasible to prevent ice or glass formation on the commonly used conductors, but impractical for the very large conductors except for relatively short distances. This statement is based on the use of a generator directly connected to the line and estimating the voltage required on the basis of 0.8 of an ohm reactance per mile. If transformers were used to step up the voltage longer lines could easily be kept free from ice formation.

When it becomes necessary to melt ice or glaze from conductors the problem is not so simple. To melt the ice it is not only necessary to supply heat for melting but also sufficient additional heat to maintain the conductor a few degrees above the temperature of freezing. The surface of the ice coating on the conductor will dissipate heat to the surrounding air just as the surface of the conductor does under the conditions of forced convection. It is very easy to see that a considerable amount of heat may be needed to raise the temperature of the conductor above freezing because of the wind, the greater area of the ice surface, and the temperature drop through the ice.

The temperature rise of the surface of the ice can be estimated by means of the same formula (1) as used for the surface of a free conductor. The radiation of heat from the surface of the ice for this condition is of the same order as from the free surface of the copper conductor. The temperature drop through the ice can be estimated from equation (3) following:

$$T = 1.151\ P\ \rho\ w_c \log \frac{d_i}{d} \qquad (3)$$

in which

T = temperature drop through the ice in C°
ρ = thermal resistance of ice (to be taken as 30).
w_c = watts per square inch on surface of conductor.
d_i = diameter over ice.
d = diameter of conductor.

The total temperature rise of the conductor will be given by equation (1) plus equation (3):

$$\theta_c = 175\ \frac{d}{d_i}\ w_c \sqrt{\frac{d_i}{v}} + 1.151\ \rho\ d\ w_c \log \frac{d_i}{d} \qquad (4)$$

This expression does not take into account any temperature drop from the conductor to the ice, so that the conductor will be hotter than calculated, other factors assumed to be correct. This error is on the safe side.

This expression can be put into the following form:

$$dw_c = \frac{\theta_c}{\frac{175}{\sqrt{d_i v}} + 34.53 \log \frac{d_i}{d}} \qquad (5)$$

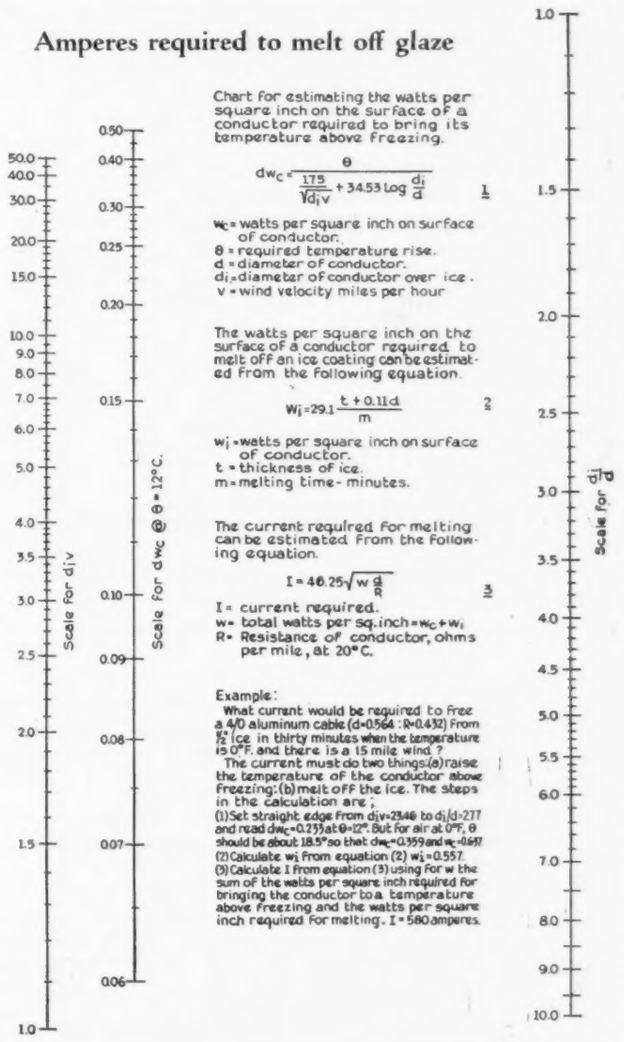
From this expression the amount of heat necessary to bring the conductor above freezing for any assumed conditions of ice thickness, wind velocity and air temperature can be estimated. Ordinarily after the ice forms on the conductor the wind velocity increases and the temperature drops.

Ice need not all be melted

To clear the conductor from ice it is not necessary to melt all the surrounding ice. It is sufficient to melt a path through the ice of about the same diameter as the wire. In Table III are shown the results of some tests in which the time to melt off ice was experimentally determined, together with the time required as calculated by the preceding formulas. It is noted that the calculated time to melt ¼-in. ice agrees quite well with the measured time. Inasmuch as neither the wind velocity nor thickness of ice in the test was given, this agreement is of value only as indicating that the method of calculation gives time values of the proper magnitude.

The method of calculation will be illustrated by the calculation of the current needed to melt ¾ in. of ice from a No. 2/0 conductor in one hour when the air temperature is 10 deg. F. and there is a 15-mile wind. The corresponding air temperature in degrees C. is —12.2 deg. C., and to melt any ice the conductor temperature must be brought to a temperature slightly above freezing, requiring a temperature rise of conductor of about 14 deg. C. The diameter of the conductor d is 0.418 in., so that the diameter d_i of the ice-coated conductor is 1.918, from which $d_i/d = 4.59$ and $d_i v = 28.8$. On substituting these values in equation (5) for the condition $\theta_c =$ 14 deg. the quantity dw_c is found to be 0.252, so that the watts per square inch on the surface of the conductor necessary to bring the temperature of the conductor from a temperature of —12 deg. C. to +2 deg. C. approximately are 0.603.

The heat to melt the ice must be supplied over and above the amount given in the preceding paragraph. The


Amperes required to melt off glaze
Chart for estimating the watts per square inch on the surface of a conductor required to bring its temperature above freezing.
$dw_c = \frac{\theta}{\frac{175}{\sqrt{d_i v}} + 34.53 \log \frac{d_i}{d}}$ 1
w_c = watts per square inch on surface of conductor.
θ = required temperature rise.
d = diameter of conductor.
d_i = diameter of conductor over ice.
v = wind velocity miles per hour
The watts per square inch on the surface of a conductor required to melt off an ice coating can be estimated from the following equation.
$w_i = 29.1 \frac{t + 0.11d}{m}$ 2
w_i = watts per square inch on surface of conductor.
t = thickness of ice.
m = melting time - minutes.
The current required for melting can be estimated from the following equation.
$I = 46.25 \sqrt{w \frac{a}{R}}$ 3
I = current required.
w = total watts per sq. inch = $w_c + w_i$
R = Resistance of conductor, ohms per mile, at 20°C.
Example:
What current would be required to free a 4/0 aluminum cable (d=0.564 : R=0.432) From ½" ice in thirty minutes when the temperature is 0°F. and there is a 15 mile wind ?
The current must do two things:(a) raise the temperature of the conductor above freezing: (b) melt off the ice. The steps in the calculation are ;
(1) Set straight edge from $d_i v$=23.46 to d_i/d=2.77 and read dw_c=0.25 at θ=12°. But for air at 0°F, θ should be about 18.5° so that dw_c=0.359 and w_c=0.657
(2) Calculate w_i from equation (2) w_i = 0.557.
(3) Calculate I from equation (3) using for w the sum of the watts per square inch required for bringing the conductor to a temperature above freezing and the watts per square inch required for melting. I = 580 amperes.
Scale for $d_i v$
Scale for dw_c @ θ = 12°C.
Scale for d_i/d

watts per square inch required for melting the ice, w_2, can also be obtained directly from the following expression:

$$w_i = \frac{29.1}{m}\ (t + 0.11\ d) \qquad (6)$$

in which m is the time of melting in minutes, t is thickness of ice and d is diameter of conductor. On substituting $m = 60$, $t = \frac{3}{4}$ and $d = 0.418$, w_i is found to be 0.386.

The total heat required is, of course, the sum of these two quantities $w = w_c + w_i$ and is 0.988 watts per square inch. Using this value and working back-

ward with equation (2) it is found that a current of about 450 amp. is required. On the basis of an impedance of 0.8 ohm per mile a 13,200-volt generator could only circulate this current through 21 miles of line, indicating that ice thawing without a step-up transformer is practical only on short lines or with the smaller conductors.

Apprehension has been felt that the high current required to melt the ice might cause temperatures high enough to anneal the copper in parts of the line where there was no ice. Assume a section of the line discussed in previous paragraphs to be located in a valley sheltered from high winds and that the surrounding air is at a temperature of about 0 deg. C. Outdoor conditions are such that it is very seldom there are no air currents at all even in sheltered locations, so that we are justified in assuming a minimum wind velocity of 2 miles per hour. The temperature rise as estimated from equation (1), after making an allowance for the increased temperature of the conductor, is about 115 deg. C. Such a temperature should do no harm. It is the practice of one operating company to use values of current up to a value which gives about 1.6 watts per square inch, which would give considerably higher temperature rises in sheltered spots. However, should there be poor joints having high contact resistance local overheating might result.

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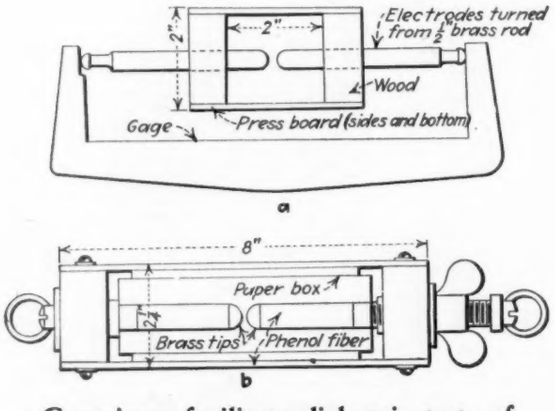
Cable Compound Tests with Discardable Containers

Removal of sticky cable-splice and pothead compounds from the electrodes and containers used in testing for dielectric strength may be eliminated by the use of two simple testing devices temporarily designated by the American Society of Testing Materials. The construction of these devices is such that their electrodes and containers are sufficiently inexpensive to permit discard after use, and the arrangement is such that these may be removed easily.



Containers facilitate dielectric tests of sticky compounds

(a) Consists of a small box having sides and bottom made from a single piece of press board attached to wooden blocks which form the ends. Holes are drilled through the wooden blocks to receive the electrodes.

(b) A more substantial type of testing device consists of a framework made from laminated phenol fiber with brass bushings inserted in each end member to hold the electrodes. A box of heavy paper or pasteboard is arranged to fit loosely inside the frame work. The electrodes, which are separable by means of screw joints, are inserted through the small holes in the end of the paper box and clamped to make an oiltight joint.

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READERS' FORUM

Preventing Ice Trouble in Hydro Plants

To the Editor of the ELECTRICAL WORLD:

The whole regiment of authorities on ice is often out of step with me. The regiment includes the N.E.L.A. hydraulic power committee and, also, this time, the writer of the editorial entitled "Ice and Water Power" in the November 8 issue of the ELECTRICAL WORLD. Almost everybody keeps talking about warming the water. To those who think all the water passing through a power house is heated, and to those who think any part of the water is heated, I would put these questions: (1) How long does the water remain in contact with the heated metal; (2) in what length of time would heat be conducted, horizontally, through one inch of water; (3) what portion of the water comes into actual contact with the metal, and (4) what difference does it make whether any of the water is warmed at all or not so long as it slips past the metal like water from a duck's back?

Water is a very poor conductor of heat, and if any of the water passing through a heated plant is warmed at all it can only be a film of water.

It is, in my opinion, misleading to think about the necessity for expending heat energy sufficient for warming such and such percentages of the whole volume of water passing through a plant. I don't believe there is any low-head plant on earth where "the volume of water is so great as to preclude the use of heat" for the prevention of ice formation.

The figures (concerning temperature rise) used in the N.E.L.A. report and in the ELECTRICAL WORLD editorial are meaningless, in my opinion, and misleading. With those figures in mind, some sufferer from ice troubles at a low-head plant may be deterred from effecting a cure.

The ELECTRICAL WORLD looks for a simpler answer or cure for ice troubles than any one has yet obtained; what could be simpler than the one I gave the Canadian Electrical Association 25 years ago: "Keep the temperature of the submerged parts of hydraulic equipments a ten-thousandth of a degree above the freezing point, and no ice will stick to them."

JOHN MURPHY,
Electrical Engineer.
Department of Railways and Canals,
Ottawa, Ont.

[For the benefit of readers who have not heard Mr. Murphy's various discussions of frazil and anchor ice and methods of combating it, they are referred to page 116, 1907, proceedings of the Canadian Electrical Association; also ELECTRICAL WORLD, page 785, April 2, 1921.—ED.]

Men of the Industry

New Assignments Made in Los Angeles Power Department

WHAT IS CONSIDERED as the first step toward the reorganization of the Los Angeles Department of Water and Power was taken by the commissioners on November 25 when the joint divisions of the department were placed under the authority of H. A. VAN NORMAN, chief engineer and general manager of the Bureau of Water Works and Supply. The joint divisions are those such as land purchasing, commercial, bookkeeping and warehouses that perform services for both the water and power bureaus.

For nearly a year past the authority has rested in the hands of E. F. SCATTERGOOD, chief engineer and general manager of the Bureau of Power and Light. A clause in the resolution of the commissioners provides that policies affecting the character of service rendered to a bureau are to be determined jointly by the two bureau managers.

Another action taken by the commissioners was the creation of new positions of electrical engineer and assistant electrical engineer in the Bureau of Water Works and Supply and the appointment of CARL HEINZE and CARL CHAPIN, respectively, to the positions. Mr. Heinze, who has been connected with the Department of Water and Power for 24 years, with the exception of the past year, formerly was assistant general manager of the combined water and power bureaus. H. A. Van Norman was general manager under this plan of operation, which was abolished a year ago in favor of separate bureaus. Mr. Van Norman became chief engineer and general manager of the Bureau of Water Works and Supply, and the position held by Mr. Heinze was abolished. Mr. Heinze has been engaged as a consulting engineer during the past year. Mr. Chapin was commercial director of the combined bureaus operating a year ago, and the position held by him likewise was abolished when the present plan of operation was resumed after approximately nine months of operation as one organization.

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W. V. A. KEMP, formerly director of research of the committee on heat transmission of the National Research Council, and more recently research secretary of the National Electric Light Association, has resigned in order to travel abroad. Mr. Kemp will study certain engineering developments in other countries, and will return to the United States in about a year, at which time he will become engaged in further engineering work.

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C. A. Leland Heads N.E.L.A. Middle West Division

C. A. LELAND, JR., who has been named by the executive committee of the Middle West Division of the National Electric Light Association as president, to fill out the unexpired term of K. R. MacKinnon of Nebraska, resigned, has

been vice-president and general manager of the public utility properties at Des Moines, Iowa, since 1927.

Mr. Leland is a native of the Middle West and his entire life has been spent in that section of the country. He was born at El Dorado, Kan., in 1887 and was graduated in electrical engineering from Kansas University in 1910. His early experience embraced connections with the Allis-Chalmers Company at the Cincinnati works, with a cement plant at Independence, Kan., and with the Terminal Railroad Company, Kansas City, Mo. Prior to the World War he was identified with the Atchison Railway, Light & Power Company at Atchison, Kan.

Following discharge from military service he went back to Atchison and then to Topeka, Kan., in charge of construction of the Tecumseh power plant. He later became general manager of the United Light & Power Company of Kansas, and in 1927 removed to Des Moines as vice-president and general manager of the Des Moines Electric Light Company and the Iowa Power & Light Company. In 1928 the Des Moines Gas Company was consolidated with these companies, and since then he has been vice-president and general manager of this company, also.

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J. M. BARRY, vice-president in charge of operations, has been elected a director of the Alabama Power Company. W. E. Mitchell and W. J. Henderson, who have removed from Alabama, have resigned as directors.

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COUNT GIUSEPPE VOLPI DI MISURATI, chairman of the board of directors of the European Electric Corporation, Ltd., sailed for Europe November 26 aboard the Cunard liner *Mauretania* after a short visit in this country. Count Volpi was formerly Italian Minister of Finance.

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WALTER D. STEELE, president of the Benjamin Electric Manufacturing Company, Des Plaines, Ill., has been elected a member of the board of governors of the National Electrical Manufacturers' Association.

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OWEN D. YOUNG, chairman of the board of directors of the General Electric Company, returned from Europe November 28 abroad the Cunard liner *Aquitania*, after a short sojourn abroad.

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EDGAR KNOWLTON, who has been connected with the alternating-current engineering department of the General Electric Company, retired on November 1 after spending 37 years in the development and design of a.-c. apparatus.

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RICHARD WOODS EDMONDS, formerly of the editorial staff of *Manufacturers Record*, and a well-known writer on industrial and technical subjects, is now associated with Korbel & Colwell, Inc., public relations counsel of New York. He will specialize in booklets and copy dealing with industrial and engineering matters. Mr. Edmonds' editorials and articles have had international circulation and have been widely quoted. His contributions to the *Review of Reviews*, *Current History*, the Boston *Transcript*,

Baltimore *Engineer, Wall Street Journal* and other Barron publications have established him as an authoritative, versatile and interesting writer in varied industrial and engineering fields.

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PROF. W. I. SLICHTER of Columbia University, New York, has been elected national treasurer of the American Institute of Electrical Engineers to fill the unexpired term ending July 31, 1931, of George A. Hamilton, resigned. Mr. Hamilton is ill and unable to continue to the end of the term.

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GUSTAVE A. BERGHOFF, president of the Wayne Home Equipment Company, Fort Wayne, Ind., and EDWARD H. BERGHOFF of the company's engineering department sailed November 12 from New York for Buenos Aires on an extensive business trip through Latin America. These men will confer with their representatives in the Argentines, the South American branch of the A.E.G., and in addition will make a comprehensive survey of business conditions in the Latin-American regions which they consider as fertile fields for American business enterprises.

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DR. ELIHU THOMSON, director of the Thomson Research Laboratory of the General Electric Company, River Works, Lynn, Mass., was awarded honorary membership in the American Society of Mechanical Engineers December 2. Ambrose Swasey made the presentation. For many years a distinguished consulting engineer and prolific inventor, D. Thomson has received recognition in this country and abroad for his scientific achievements in the form of medals, fellowships and official positions, active and honorary, in technical societies.

•

R. W. STAUD, advertising and sales promotion manager of the Benjamin Electric Manufacturing Company, Des Plaines, Ill., has been elected vice-president and secretary of the Porcelain Enamel Institute, Inc. Mr. Staud is president of the Engineering Advertisers' Association of Chicago, a member of the industrial and commercial lighting committee and of the national outdoor lighting committee of the Commercial Section of the National Electric Light Association and chairman of the manufacturers' advisory committee of the lighting service committee of the Illuminating Engineering Society.

•

EARL H. BARBER, consulting engineer of Reading, Mass., has been appointed to make a survey of the power needs of the District of Columbia, for which Congress appropriated $25,000 last July with a view to establishing a municipally owned and operated service. Mr. Barber has been intimately identified with the regulation, financing and operation of public utilities in Massachusetts for the past fifteen years and at present is adviser to the commission of the Department of Public Utilities for Massachusetts. Mr. Barber expects to take up his new duties early in 1931.

•

CHARLES W. ABBOTT, formerly director of low-tension engineering, General Cable Corporation, has recently joined the advertising firm of Moser & Cotins, Brown & Lyon, Inc., in the capacity of vice-president. Mr. Abbott has been identified with the electrical industry for more than twenty years, as an engineer with central stations, as an officer of manufacturing companies, as an inventor of recognized and widely used material, as sales manager and buyer of advertising and as a member of committees of the National Electrical Manufacturers' Association, and other leading organizations. Moser & Cotins, Brown & Lyon, Inc., has offices in New York City and in Utica.

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R. W. E. MOORE has been appointed chairman of the standards committee of the National Electrical Manufacturers' Association for the coming year. Mr. Moore, who is engineering manager of association activities of the Westinghouse Electric & Manufacturing Company, has had many years' experience in such work.

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STEPHEN K. MAHON of Toledo, Ohio, has become assistant to C. L. Proctor, vice-president and general manager of the Toledo Edison Company. Dr. Mahon is an outstanding leader in civic affairs of Toledo.

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JOHN ALLEN CLAY was the guest of honor at a banquet held December 1 at the Community Club in Durango, Colo. The occasion marked the twenty-fifth anniversary of Mr. Clay's association with the Colorado company in the capacity of general manager. Many of Mr. Clay's business associates and friends attended.

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W. G. PETERSON, formerly director of personnel for the Westchester Lighting Company, Mount Vernon, N. Y., was promoted to the position of assistant treasurer and commercial manager of the Bronx Gas & Electric Company. Mr. Peterson is a past-president of the Mount Vernon Rotary Club and is a director of the Westchester Bond & Mortgage Company. In addition to his present duties as assistant treasurer of the Westchester Lighting Company R. S. PRUYN will assume the position of director of personnel, left vacant by Mr. Peterson's leaving for the Bronx company.

OBITUARY

CHARLES E. HULL, president of the Southern Berkshire Power & Electric Company, Stockbridge, Mass., died suddenly, November 29, in his sixty-ninth year.

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LAURENCE F. WALSH, since 1910 assistant manager of the Pacific Gas & Electric Company's San Francisco division, died suddenly of a heart attack in that city, November 13. He was 64 years of age.

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GEORGE R. ELDER, who recently retired from the office of vice-president of the Ingersoll-Rand Company, New York, died November 29 at his home in Waterford, N. Y. A native of Johnstown, Pa., Mr. Elder received his technical education at the Troy Polytechnic Institute. He was 68 years of age.

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LOWELL W. MILES, employment manager for the Insull interests in Indiana, died of pneumonia at his home in Indianapolis after a week's illness. A native of Elwood, Ind., and a graduate of Indiana University, Mr. Miles became associated with Robert M. Feustel of the Indiana Service Corporation at Fort Wayne. He did appraisal work, and when Mr. Feustel removed to Indianapolis Mr. Miles went with him and received the appointment to the position of employment manager.

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WALTER R. TIMPER, sales manager of the General Electric Supply Corporation, Boston, Mass., died at the Palmer Memorial Hospital in that city on December 1, following a seven months' illness. Mr. Timper was born at Brooklyn, N. Y., about 41 years ago and had been engaged in the wholesale electrical supply field during all his adult life. He was formerly merchandising manager of the Pettingell-Andrews Company, Boston, predecessor of the General Electric Supply Corporation, and had been employed by the organization for the last fifteen years.

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DR. RICHARD MOLDENKE, well-known metallurgical and mining engineer, died in Plainfield, N. J., November 17, after a short illness. He was 66 years of age. Dr. Moldenke was consulting metallurgist to a number of American companies and the author of several technical works. He specialized on the metallurgy of cast iron and was an expert in malleable castings. For a time he was attached to the Coast and Geodetic Survey, doing pioneer work in electric power development, and in 1889 he organized the mechanical and electrical engineering departments of the Michigan College of Mines. He was a graduate of Columbia University.

Financial and Statistical News

A FURTHER decline of more than half-a-billion dollars took place during November in the prices of public utility stocks listed on the New York Stock Exchange. Power and light stocks alone showed a loss of more than $369,000,000. The decline in values of the same group during October amounted to $636,000,000.

——MARKET SENTIMENT HAS CONTINUED BULLISH during the past week (to December 3), but activity on the buying side has been very limited. Power and light common stocks as a group have recovered around 15 per cent from their low points and continue to show very satisfactory resistance on recessions.

——BUDGET FIGURES FOR 1931, now beginning to make their appearance, show a 5 per cent increase in projected construction, although it is yet too early to make estimates for the entire industry.

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Railroad Electrification Boosts Public Service Power Sales

INDUSTRIAL POWER SALES of the Public Service Electric & Gas Company, Newark, N. J., during the month of October were 94,759,000 kw.-hr., a gain of 1,467,221 kw.-hr. over October of last year. This gain is largely attributable to the power sold to the Lackawanna Railroad for electrification of its lines, which began during October in the territory served by Public Service Electric & Gas Company. During the month of October total electric sales were 149,408,064 kw.-hr., compared with 141,434,512 kw.-hr. sold in October, 1929, a gain of 7,973,552 kw.-hr., or 5.64 per cent.

Sales of electricity for the first ten months of 1930 totaled 1,396,415,163 kw.-hr., a gain of 4.39 per cent over the corresponding period last year. Industrial power sales for the first ten months of this year totaled 881,298,365 kw.-hr., compared with 881,011,230 kw.-hr. in the corresponding period of 1929, a gain of 287,135 kw.-hr. Compared with the corresponding period two years ago sales of industrial power in 1930 showed a gain of 22 per cent.

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Receiver Charges Foshay Plan Fraud

THAT THE FOSHAY ORGANIZATION operated its affairs in its own interests and in a manner that was fraudulent to the creditors was charged by Judge C. J. Rockwood, receiver for the company. A statement was filed before the federal court that the $6,844,825 claim of the Public Utilities Consolidated Corporation, a Foshay subsidiary, should not be allowed.

The organization plan for these two companies was such that assets were in Public Utilities Consolidated Corporation and liabilities and operating expenses in the Foshay Company, Mr. Rockwood stated. Under this plan the Foshay Company creditors took all the risk in the event of failure, he said, and got none of the benefits in the event of success. Judge Rockwood said:

The effect of this plan of operation was that if Foshay was successful in this extensive expansion and promotion program the stock of Public Utilities Consolidated Corporation, of which the Foshay Company held the voting majority, would be very valuable, and Foshay, through his personal ownership of stock in the Foshay Company, would derive large profits.

On the other hand, if Foshay failed in this program and his companies went into receivership, the creditors of the Foshay Company would receive only a small percentage of their claims, due to the enormous claim of Public Utilities Consolidated Corporation against the Foshay Company.

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Few Light and Power Bonds in Default

IN A COMPILATION recently prepared by Dow, Jones & Company listing public utility bonds few light and power issues appeared. The accompanying table gives the details:

Name	Amount	Defaulted
Atlantic Public Service Associates, Inc., 1st 5½s*	$4,938,000	Aug., 1930
debenture 6s*	2,000,000	Aug., 1930
Atlantic Public Utilities 6s, 1930	1,500,000	Aug., 1930
North American Water Works & Electric convertible 6s*	2,798,000	Nov., 1930
Suburban Light & Power 1st 5½s*	2,500,000	May, 1930
debenture 6s*	1,000,000	Dec., 1929
Tacoma Railway & Power 5s, 1929	1,236,000	Apr 1, 1928

*Default as to interest only.

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Recommendations on Issue of Utility Securities

IN AN attempt to achieve uniform laws on the issuance of public utility securities the National Association of Railroad and Utilities Commissioners made a number of suggestions at its recent annual meeting in Charleston, S. C. Some of the outstanding recommendations follow:

Section 77. *Property Acquired to Be Valued.*—No public utility corporation shall acquire or obligate itself to acquire, directly or indirectly, the property or a majority of the voting stock of another public utility corporation unless the property or stock to be acquired shall first have been valued by the commission, and then only at an amount not to exceed the value so determined.

Section 79. *Consideration for Securities Issued.*—No public utility corporation shall issue any stock having a nominal or par value for less than such nominal or par value, or any stock without nominal or par value, except for such consideration as the commission may authorize, or any evidence of debt for less than such percentage of the face value as the commission may require as a minimum.

Section 81. *Bonds Reasonably Proportionate to Stock.*—The amount of evidence of debt which any public utility corporation may issue shall bear a reasonable proportion to the amount of stock issued, due consideration being given to the nature of the business of the corporation, to its credit and prospects, to the effect which such issue will have upon the management and operation of the corporation by reason of the

relative amount of financial interest which the stockholders will have in the corporation, and to other circumstances.

Section 82. *No Dividends While Deficit Exists.*—If, after the issuance of any securities, any public utility corporation shall have a deficit after giving effect to the true value of its assets and to the full amount of its liabilities as determined by the commission, it shall not pay any dividend until such deficit has been eliminated. The commission may appraise the assets and liabilities of the corporation whenever it shall be of the opinion that the capital accounts, as carried in the corporation's books, do not correctly represent the cost of the assets of the corporation, or that the amount of the liabilities of the corporation are incorrectly stated in said books, or that the value of the assets of the corporation are less than its liabilities, including its outstanding stock.

Section 84. *Pledge of Securities.*—The commission may authorize in its certificate any public utility corporation to pledge any evidence of debt issued by it as security for any lawful debt of or loan to such corporation, but the terms of the pledge shall provide that none of the pledged securities shall be sold or become the absolute property of the pledgee either directly or indirectly, except at public sale, notice whereof shall be published once a week for not less than three successive weeks prior thereto in at least one newspaper of general circulation printed in the English language and published in the place where such sale shall take place, and except at a price not less than the price fixed by the commission in the certificate of authority authorizing the sale or pledging of any such securities.

Section 86. *Accounting for Proceeds.*—The commission may require issuers to account for the disposition of all securities requiring its approval. If the securities are issued for money it may require the issuer to report the price at which the securities are issued, the amount of securities so issued, and the amount of money received therefor. If they are issued for the refunding or discharge of securities or other indebtedness it may require the issuer to report, in such detail as it may require, the amount of securities issued for such purpose, the price at which issued, and the amount or nature of securities or other indebtedness refunded or discharged by such issuance. If they are issued for the acquisition of property or services it may require the issuer to report, in such detail as it may require, the amount of securities issued for such purpose, the price at which issued, and information regarding the property of services for which such securities were issued.

Section 87. *Valuation of Franchises.*—In determining the value of property under this chapter, no franchises to be a corporation and no franchises or privilege granted to a corporation shall be appraised at more than the sum paid therefor to the state or municipality granting the same.

NEWS BRIEFS

At a meeting of the directors of the American Power & Light Company held November 10 a stock dividend of 6/50ths of a share (comprising the regular semi-annual stock dividend of 1/50th of a share, or 2 per cent, and an extra dividend of 5/50ths of a share, or 10 per cent) was declared on the outstanding common stocks of the company payable December 1 to holders of record November 20.

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American Gas & Electric directors have declared an extra stock dividend of 20 per cent on common stock in addition to the regular cash and stock dividends on common.

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Stockholders of the Gardner (Mass.) Electric Light Company have voted to increase the capital stock by the issue to common-stock-holders of record October 21 of 2,500 shares of additional common stock (par $100), such an increase having been approved by the Massachusetts Department of Public Utilities. The price at which the stock will be offered is $133.33 per share.

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New Financing in November Totaled $74,100,000

NEW security offerings by the electric light and power companies of the country amounted to $74,100,000, as compared with $51,819,600 in October, bringing the total for the eleven-month period up to $1,250,111,534, as against $798,860,000 for the similar period of 1929. Twelve individual companies participated in the month's activities. Short-term issues predominated, eight offerings being notes maturing in from one to three years. The largest individual offering was made by the New England Power Association in the form of gold notes amounting to $20,000,000. The average yield recovered to the 5.03 per cent mark, as compared with 4.55 per cent in October.

New Security Issues of Electric Service Companies in November

Name of Company	Amount	Period (Years)	Class	Purpose	Interest Rate	Price	Per Cent Yield
American Community Power Co.	$1,800,000	1	Secured gold notes	Proceeds will be used to reimburse the company for expenditures made in connection with improvements to the properties	5½	99½	6
New York State Elec. & Gas Corp.	6,700,000	1	First mortgage gold bonds	To repay indebtedness incurred for additions to properties	3¾	99¾	4
Arizona Edison Co.	1,500,000	1	Gold notes	To retire unfunded indebtedness, for additions and betterments and other corporate purposes	5	99½	5.52
Central Ohio Light & Power Co.	3,600,000	20	First mortgage gold bonds, series A	Acquisition of properties and for other corporate purposes	5	90	5.80
Green Mountain Power Corp.	1,500,000	1	Gold notes	To retire unfunded debt, for additions and betterments and for other corporate purposes	4½	99½	5.01
Illinois Power & Light Corp.	8,500,000	26	First and refunding mortgage gold bonds, series C.		5	95½	5.32
New England Power Association.	20,000,000	2	Gold notes	To retire bank loans, for the payment of obligations incurred in the acquisition of subsidiary companies' securities and for other corporate purposes	5	99½	5.25
Northern States Power Co. (Minn.)	10,000,000	1	Gold notes	To retire current indebtedness and to reimburse the company for extensions and additions already made and now being made to the properties	4	99¾	4.25
Peoples Light & Power Corp.	1,000,000	½	Gold notes	To retire indebtedness	5	99¾	5.51
	2,000,000	1	Gold notes		5	99¼	5.78
City of Tacoma (Washington) Elec. Light & Power Dept.	500,000	3-16	Bonds		4¾	....	4.50 to 4.70
Washington Gas & Electric Co.	3,000,000	25	First mortgage gold bonds.		5	90	5.75
Northern Indiana Public Service Co.	14,000,000	40	First and refunding mortgage gold bonds, series E.	To reimburse for expenditures already made, construction, to retire bonds and for other corporate purposes	4½	92	4.96
Total	$74,100,000			Rights		$11,653,325	
Total amount actually realized.	71,755,500			Total financing for November		$83,408,825	

Overproduction of Power in Quebec Unlikely

ACCORDING TO A STATEMENT issued recently by the Shawinigan Water & Power Company, primary power sales for the first seven months of the current year totaled 1,553,862,342 kw.-hr., an increase of 15,356,429 kw.-hr. over the corresponding period of 1929, while secondary power sales, made at approximately one-tenth of a cent a kilowatt-hour to dispose of off-peak power, were 413,673,882 kw.-hr., a decrease of 24,311,729 kw.-hr. On August 1 last the company had 8 per cent more power sold under firm contract than during last year.

Discussing the market outlook for the additional power to be brought into production at the company's Rapide Blanc plant on the St. Maurice River late in 1932 or early in 1933, Julian C. Smith, vice-president and managing director, stated that the company did not anticipate any difficulty in disposing of the new output, which will amount to approximately 100,000 hp. He did not think there was any likelihood of overproduction developing in the Quebec market. He pointed to the situation as it existed in 1917-18. At that time Laurentide Power and Shawinigan brought into production a large amount of electric energy and there was an apparent overproduction, but the situation righted itself in a short while. Mr. Smith indicated that there were several outlets which would assure the taking up of power from the Rapide Blanc development as it became available.

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

OPERATING COMPANIES

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
Alabama Power*					
(Year ended October 31)					
Gross earnings	$18,009,272	$18,341,705	—1.8	42	38
Net earnings	10,436,601	11,368,127	—8.2	..	..
Arkansas Power & Light					
(Year ended September 30)					
Gross earnings	8,902,913	8,190,782	9.0	53	51
Net earnings	4,157,787	3,995,465	4.0	..	..
Carolina Power & Light					
(Year ended September 30)					
Gross earnings	8,931,176	9,353,270	—5.0	44	46
Net earnings	4,981,020	5,076,794	—2.0	..	..
Consumers Power					
(Year ended October 31)					
Gross earnings	32,662,144	33,320,037	—2.0	46	49
Net earnings	17,685,348	16,892,816	4.7	..	..
Detroit Edison					
(Year ended October 31)					
Gross earnings	54,308,133	56,431,624	—3.8	68	66
Net earnings	17,386,510	19,206,234	—9.5	..	..
Georgia Power*					
(Year ended October 31)					
Gross earnings	24,360,816	23,892,848	2.0	50	47
Net earnings	12,264,441	12,675,253	—3.3	..	..
Houston Lighting & Power					
(Year ended September 30)					
Gross earnings	8,764,353	7,762,085	13.0	52	53
Net earnings	4,218,746	3,626,169	16.0	..	..
Kansas City Power & Light					
(Year ended October 31)					
Gross earnings	14,734,224	14,533,094	1.4	49	51
Net earnings	7,561,159	7,141,589	5.9	..	..
Kansas Gas & Electric					
(Year ended September 30)					
Gross earnings	6,049,285	5,687,957	6.0	53	53
Net earnings	2,856,756	2,691,244	6.0	..	..
Louisville Gas & Electric					
(Year ended September 30)					
Gross earnings	10,510,318	10,153,981	3.5	..	..
Net earnings	5,359,851	5,267,426	1.7	..	..
Memphis Power & Light					
(Year ended September 30)					
Gross earnings	6,740,756	6,003,906	12.0	59	60
Net earnings	2,751,308	2,401,809	15.0	..	..
Minnesota Power & Light					
(Year ended September 30)					
Gross earnings	6,465,525	6,200,574	4.0	39	36
Net earnings	3,941,198	3,981,529	—1.0	..	..
Nebraska Power					
(Year ended September 30)					
Gross earnings	6,467,841	5,838,968	11.0	50	51
Net earnings	3,278,210	2,867,117	14.0	..	..
Northern States Power					
(Year ended September 30)					
Gross earnings	33,160,054	32,424,707	2.3	..	..
Net earnings	16,437,440	16,637,330	—1.2	..	..
Ohio Edison					
(Year ended October 31)					
Gross earnings	19,305,702	19,291,782	0.0	40	43
Net earnings	11,616,387	11,065,661	5.0	..	..
Oklahoma Gas & Electric					
(Year ended September 30)					
Gross earnings	14,753,251	13,795,948	7.0	..	..
Net earnings	6,962,367	6,544,763	6.4	..	..
Pacific Gas & Electric†					
(Nine mos. ended Sept. 30)					
Gross earnings	56,346,113	48,705,579	15.6	44	48
Net earnings	31,589,448	25,145,165	25.6	..	..
Pennsylvania Power & Light					
(Year ended September 30)					
Gross earnings	30,862,959	29,884,008	3.0	50	50
Net earnings	15,662,927	14,829,215	6.0	..	..
Southern California Edison					
(Year ended October 31)					
Gross earnings	41,168,772	39,512,954	4.0	33	33
Net earnings	27,773,471	26,280,221	6.0	..	..
Tennessee Electric Power					
(Year ended October 31)					
Gross earnings	15,163,511	14,369,892	5.5	52	52
Net earnings	7,280,071	6,984,285	4.2	..	..
Texas Power & Light					
(Year ended September 30)					
Gross earnings	9,993,534	9,823,713	2.0	49	50
Net earnings	5,094,887	4,839,597	5.0	..	..
Utah Power & Light					
(Year ended September 30)					
Gross earnings	11,536,940	11,609,829	—1.0	51	50
Net earnings	5,639,260	5,805,028	—3.0	..	..

HOLDING COMPANIES

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
American & Foreign Power Subs.					
(Year ended August 31)					
Gross earnings	76,640,554	52,072,138	47.0	..	..
Net earnings	38,212,586	26,731,490	43.0	..	..
American Commonwealths Power & affiliated cos.‡					
(Year ended September 30)					
Gross earnings	27,675,679	22,987,488	20.4	53	57
Net earnings	12,944,831	9,924,118	30.4	..	..
(Year ended October 31)					
Gross earnings	27,809,760	23,361,740	19.0	52	56
Net earnings	13,164,627	10,195,578	29.3	..	..
American Light & Traction & Subs.					
(Year ended September 30)					
Gross revenue	45,780,069	46,437,420	—1.4	64	65
Net revenue	16,285,017	16,025,970	1.6	..	..
American Water Works & Electric & Subs.					
(Year ended September 30)					
Gross revenue	54,905,671	53,287,642	3.0	50	51
Net revenue	27,278,118	26,382,645	3.4	..	..
Columbus Gas & Electric & Subs.					
(Year ended September 30)					
Gross revenue	101,158,348	106,532,980	—5.0	50	48
Net revenue	50,124,551	54,972,378	—8.8	..	..
Commonwealth & Southern & Subs.					
(Year ended October 31)					
Gross earnings	143,368,933	146,902,994	—2.4	49	49
Net earnings	73,206,034	75,105,863	—2.5	..	..
Engineers Public Service & constituent cos.					
(Year ended September 30)					
Gross earnings	52,792,509	47,253,875	11.7	57	57
Net earnings	22,447,518	19,937,218	12.6	..	..
Middle West Utilities Sub.					
(Year ended September 30)					
Gross earnings	179,971,421	152,179,830	18.2	..	..
Net earnings	33,567,275	26,385,327	27.0	..	..
New York State Electric & Gas & Subs.					
(Year ended September 30)					
Gross earnings	12,608,329	11,171,987	13.0	60	61
Net earnings	5,018,176	4,366,550	14.9	..	..
North American Light & Power & Subs.					
(Year ended September 30)					
Gross earnings	47,020,851	45,057,936	4.4	55	56
Net earnings	21,066,236	19,827,682	6.2	..	..
Philadelphia Company					
(Year ended September 30)					
Gross earnings	62,473,437	63,040,377	—0.9	..	..
Net earnings	30,520,633	30,668,199	—0.5	..	..
Public Service Corporation of New Jersey & Subs.					
(Year ended October 31)					
Gross earnings	139,014,356	135,065,231	2.9	68	69
Net earnings§	43,149,346	41,152,666	4.8	..	..
Standard Gas & Electric, affil. Cos. & Subs.					
(Year ended September 30)					
Gross earnings	154,641,424	152,367,731	1.5	..	..
Net earnings	73,990,621	72,832,595	1.6	..	..

* 1929 includes gas properties sold May 1, 1929, Georgia Power includes Columbus Electric & Power from May 1, 1930.

† Includes operation of Great Western Power, San Joaquin Light & Power and Midland Counties Public Service from June 12, 1930.

‡ In November 8, 1930 issue figures covering September, 1930 and September 1929 were transposed in error.

§ Operating expenses include depreciation.

Business News and Markets

Power Show Mirrors Progress of Year Throughout Electrical Field

FOUR HUNDRED exhibitors this week displayed and demonstrated to probably 140,000 visitors the year's progress and the cumulative result of many years of research and development in the adaptation of power to all branches of industry. The occasion was the ninth National Exposition of Power and Mechanical Engineering—the Power Show.

There were no evidences of the effect of business depression at the Power Show. Radically new developments were probably fewer this year than last, but there were numerous adaptations and modifications and a fair number of new applications and designs. There has been a notable increase in the use of bakelite and aluminum and an expansion in the use of Selsyn motors to obtain remote control and remote indications in industrial practice. There was, incidentally, a marked increase this year in attendance by students from nearby colleges, technical schools and high schools.

While there was little variation this year from previous years in the general type of exhibit, there appeared to be greater emphasis on refinements of various kinds. Precision instruments and recording devices were abundant generously represented.

One of these measuring devices, for example, measures to within one-hundred-thousandth of an inch, by an electrical process. It is especially useful for cylinder measurement. A tiny diamond point is inserted in one end of a small bar armature, connected with two coils and a rectifier to give tolerance indications on a delicate ammeter.

Distance indicators and remote-control devices were also shown by different exhibitors. A new type of graphic barometer combines the vacuum gage and barometer principles to give absolute pressure. A liquid level gage measures volume under pressure. A newly designed viscosimeter has automatically controlled temperature. A new self-contact recording pyrometer, every part of which is dead except when a change in temperature takes place, was displayed. A recording instrument measures percentage of condenser leakage and indicates excesses by signal lights.

One company displayed an automatic circuit breaker which combines in one unit the instantaneous action of the magnet with the time lag of the thermal element to give comprehensive and selective protection. It was designed primarily to replace fuses, cutouts and branch circuit switches as a means of controlling branch circuits up to 15 amp. capacity. Another application is the protection and control of small motor-driven apparatus. Another exhibit which attracted considerable attention included a circuit breaker, also combining time limit and instantaneous overload, either function being independent of the other. It is provided with remote solenoid control, with hand control for emergency. Safety is a feature claimed, for it, as every live part is inclosed in steel.

For the safe control of power and light distribution systems one company exhibited an interchangeable unit panelboard. It provides for changes in the size of branch circuit fuses and also for changes in line voltage or from direct to alternating current.

As a means of keeping the peak load down rather than being charged on the basis of a peak far in excess of normal requirements, a power demand limitator was shown. It may be connected to any part or parts of the plant load that can be conveniently reduced and set for the desired maximum demand. When the demand reaches the setting of the limitator, the latter functions to so reduce the load as to hold the demand within the predetermined maximum.

The exhibits included also a number of interesting applications of the photoelectric cell and thermionic tubes generally to signaling systems in hundreds of day-to-day uses.

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Says Commission Delay Checks Radio Business

THE VOLUME OF BUSINESS in the radio industry is being limited by the delay of the Federal Radio Commission in granting 27 high power broadcasting applications now before it, according to O. H. Caldwell, formerly Federal Radio Commissioner and editor of *Radio Retailing* and *Electronics*. Speaking at the fall convention of the Institute of Radio Engineers in Rochester recently, he said also that the commission's delay is holding up hundreds of millions of dollars of potential radio receiver sales.

On account of the approaching saturation of the home market for radios, Mr. Caldwell pointed out, many leading executives of the radio industry predict a marked falling off of radio-set sales in 1931 and 1932, figuring that from one to two million less sets may be sold in each of these years as compared with 1929 and 1930. The former Federal Radio Commissioner pointed out, however, that while saturation of from 50 to 60 per cent is being approached in regions already served with radio broadcasting, vast areas of the United States are still without broadcasting services.

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One Million New Electric Refrigeration Users in 1931

NO RECENT DEVELOPMENT is of more interest in central-station industry and in electric refrigeration circles than is the newly formed electric refrigeration bureau, in the Commercial National Section of the National Electric Light Association. The electric refrigeration bureau, to put it briefly, will be an association of thousands of local electric refrigeration bureaus. Each of these local bureaus will have as its members all the local people who are concerned with the sale of electric refrigerators, including manufacturers, distributors and dealers. A considerable part of its membership will be composed of central-station commercial executives concerned with the growth of domestic consumer load and revenue through the sale of electrical appliances. The aim and purpose of the bureau is simply and clearly to stimulate the sale of electric refrigerators through continuous co-operative advertising, both national and local, and through intensive selling effort.

The plan contemplates organizing as rapidly as possible a local electric refrigeration bureau in every town and city. This local bureau will be a center of enthusiasm and it will encourage the keen and healthy sales competition of its members. It will discourage unfair or destructive competition. It will bring together all local interests in a co-operative or joint advertising campaign which

will not lessen or detract from the amount of individual advertising carried on by each individual sales outlet.

The bureau is sponsored by the National Electric Light Association and supported by the leading electric refrigerator manufacturers. James E. Davidson, president of the Nebraska Power Company, has been chosen as the national chairman and leader, and there is a national executive committee, whose membership is composed of well-known men in the electric refrigeration industry and also of men of proved leadership in the central-station business. This national executive committee is assisted by a plan committee, by the National Electric Light Association and by a permanent field force. Twelve regional directors have been appointed, each responsible for the success of the undertaking in his territory. With this centralized and regional organization established, the way is clear for the rapid formation of local electric refrigeration bureaus in every state and district in the United States and in every province in Canada. A continuous campaign of advertising in the foremost national magazines will begin just prior to April 1 and will continue throughout 1931.

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N. E. M. A. Standards Committee Meets

AT A MEETING of the standards committee of the National Electrical Manufacturers' Association held on October 22 a number of actions were taken, as indicated in the following paragraphs:

Indorsement of I.E.C. Actions.—The committee indorsed the actions of the United States delegates to the International Electrotechnical Commission meeting at Stockholm in July, 1930, including the agreements reached on temperature rise of transformers, motors and generators, and the tolerances allowable under guarantees. The approved matter is the "2 (Secretariat) 212" modified as per the résumé prepared before the meeting by advisory committee No. 2 on rating of electrical machinery.

Switchgear Standards.—The standards committee approved certain standard steps of interrupting capacity and ampere rating of oil circuit breakers and standard ratings for bus structures for metal-clad switchgear.

Dielectric Strength of Fish Paper.—Standard rules on dielectric strength of fish paper were approved by the committee as follows: Thicknesses of 0.004 to 0.005 in. inclusive, 200 volts per mil; over 0.005 to 0.015 in. inclusive, 300 volts per mil; over 0.015 to 0.040 in. inclusive, 250 volts per mil.

Committee on Abbreviations and Symbols.—A joint committee of the industrial control and switchgear sections was authorized for considering symbols and abbreviations for industrial power and switchboard control for ultimate submission to the American Standards Association.

Zinc-Coated Sheets.—The committee indorsed the report of the A.S.T.M. Specifications A-93-27 for zinc-coated iron and steel sheets, which is now before a sectional committee of A.S.A.

Investigation of Noise Measurement.—The committee approved on September 26 a request of the motor and generator section for contact with outside bodies which are investigating means for measuring noise produced by electrical equipment such as motors and control apparatus.

Specifications for Crane Controllers.—Specifications for a.c. and d.c. magnetic controllers for general-purpose traveling cranes were approved by the committee on September 26.

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TRADE BRIEFS

Weston Electrical Instrument Corporation will redeem on January 1 next 12,600 shares of its class A stock at $37.50 and dividends.

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A new million-dollar transformer tank shop is to be erected at the General Electric plant in Pittsfield, Mass.

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J. K. Webb has been appointed Texas representative for the Allen-Bradley Company, Milwaukee, Wis. He is an electrical engineer and well acquainted with the Texas territory. His office is located at Dallas.

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Ward Leonard Electric Company, Mount Vernon, N. Y., announces the appointment of R. C. James as sales representative in the Seattle district.

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C. H. Wheeler Manufacturing Company, Philadelphia, Pa., announces that Thomas B. Whitted, assistant to the vice-president, will be in charge of the New York office, which has recently moved to the Woolworth Building.

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Okonite Company announces the appointment of J. E. Harrall as sales representative to the light and power industry in the district which centers around Philadelphia.

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Announcement has been made of the appointment of E. S. Conrad, who recently was made general sales manager of the Diamond Electrical Manufacturing Company, with headquarters in Los Angeles, to the position of vice-president in charge of operations of the Square D Company of Texas. The Square D Company of Texas is the new name of the Diamond Electrical Manufacturing Company of Texas and it will operate as a separate unit, handling the sale of Diamond E, Square D and Industrial Controller material in the states of Texas, Louisiana, Oklahoma, Mississippi, Arkansas and part of Tennessee. The company has a manufacturing plant at Houston, Tex.

Blaw-Knox Earnings Close to Those of 1929

NET PROFITS FOR 1930 equal to or greater than those of 1929, according to officials of the Blaw-Knox Company, have been reported. Last year net profit was $2,838,734, equal to $2.16 a share. The stock is on an annual dividend basis of $1.50, so that requirements for the present year should be earned by a comfortable margin.

Substantial orders are being received from cities in New Jersey, Pennsylvania, New York and Illinois. This reflects municipal improvement programs. Foreign business has been growing and plants were recently opened in England and France.

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Cleveland Has New Patent Service

THROUGH A NEW SERVICE established by the Industrial Development Department of the Chamber of Commerce, inventors may submit descriptions of their devices. These are then listed in a letter which is sent to more than 2,000 manufacturers. The man with an idea only is also encouraged, although it is suggested that he protect himself if patents have not yet been applied for.

Those taking advantage of this patent and idea service are urged to submit full details with the first letter. Communications should be sent to Industrial Development Department, Chamber of Commerce, 1704 Terminal Tower, Cleveland.

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Copper Remains Dull at Higher Price

COPPER BUSINESS during the last week has been of about the same volume as the week before, with the custom smelters and allied producers monopolizing the business. The large producers continue to hold at 12 cents for Eastern and 12⅛ cents for Middle Western deliveries, but are doing no business so long as there are cheaper offerings by others. A week ago a small tonnage was sold at from 10½ to 10¾ cents, and the next day most of what little business there was averaged up to 10¾ to 11 cents.

	Nov. 26, 1930 Cents per Pound	Dec. 3, 1930 Cents per Pound
Copper, electrolytic	10⅛	11⅛
Lead, Am. S. & R. price	5.10	5.10
Antimony	7⅛	7.10
Nickel, ingot	35	35
Zinc, spots	4.10	4.07½
Tin, straits	25⅛	25⅛
Aluminum, 99 per cent.	23.30	23.30

Market Conditions

DECEMBER opened with equipment business on a low level and sales radically restricted and on a hand-to-mouth basis in the Eastern district. Day-to-day business on the Pacific Coast continues about average, high-tension insulators being a feature.

——STREET-LIGHTING SALES ARE INCREASING in New England, but heavy equipment is quiet.

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PACIFIC COAST

—SEVERAL LARGE ORDERS *for high-tension insulators are to be placed this year, including two carloads for the Fresno area and half a train-load for connection with the Boulder Dam project in the south-eastern part of the state.*

—OTHER *large prospective business includes $80,000 worth of paper and leaded power cable for the south-ern California area.*

Some excellent machinery orders are reported, including a 2,000-kva. turbo-alternator switchboard and panel for the government plant at Mare Island, $20,000 worth of relays, oil circuit breakers and transformers for Hono-lulu, $15,000 worth of induction heater regulators for Portland, six General Electric regulators, valued at $5,500, for King City and a similar order for San Jose, three 250-hp. motors, com-pensators and controls valued at $8,500 to provide a pumping hookup for the city of San Francisco, an 800-hp. General Electric motor valued at $9,000 sold to a San Francisco waterwheel company for Idaho installation and two marine sets for a ferryboat on San Francisco Bay, covering generating mo-tors and the main generator set. West-inghouse reports $20,000 worth of elevator motors, generator sets and con-trols for Los Angeles installation. Other sizable orders include a $53,375 electrical contract for the Olympic Club building at San Francisco, a $200,000 project to provide additional power for the East Bay district from the Mokelumne River, an $800,000 health center building for San Francisco, underground electric service for twelve units of barracks for March Field, near Riverside, and such outstanding major construction projects as a $5,000,000 40-acre health sanatorium for Phoenix, Ariz., a $6,000,000 budget for various California hospitals and homes, includ-ing $750,000 jobs at Agnew, Eureka and Sonoma, and a six-month branch bank construction program, totaling $600,000, for southern California.

Although conditions showed no improvement over other weeks in November, last week's volume was deemed fair by jobbers in the Puget Sound district. Sales reported included fifteen crest gates, costing $40,000, for spillway of Rock Island dam to the Puget Sound Power & Light Company by the Pacific Car & Foundry Company, one double drum electric hoist equipped with 100 hp., 440-volt motor, costing $3,645, to the city of Seattle, 54 motors, made by Westinghouse, ranging from 15 hp. down to a King County sawmill, approximately $4,000 worth of miscel-laneous switchgear to Puget Sound cen-tral stations, about ten motors from 75 hp. down to a pulp mill in eastern Wash-ington and about 40 motors from 50 hp. down to dealers and small industrials, the latter sales divided among several jobbers. City of Seattle Purchasing Department has opened bids for 10,000 standard eight-pin unpainted crossarms and the Lighting Department has asked Council for $180,000 for an underground system at Broodmoor, extension to south end substation and for telephone construction. Five applications for water rights on Deschutes River in Oregon, contemplating expenditure of $18,500,000 in hydro-electric plants, were filed with the State Engineer at Salem, and the federal government has granted applications of the Zellerbach interests for power and pulp mill proj-ects near Juneau and Ketchikan, Alaska, costing about $30,000,000.

CONSTRUCTION PROJECTS

San Joaquin Light & Power Corpora-tion, Fresno, Calif., will build a power substation at Herndon, to cost $540,000, and has authorized a steel tower trans-mission line from that place to Fresno and vicinity, to cost $870,000. I. and J. D. Zellerbach, Zellerbach Paper Company, San Francisco, Calif., have secured per-mission to construct a hydro-electric power plant near Ketchikan, Alaska, to develop a capacity of 65,500 hp., to cost about $5,000,000. Coast Counties Gas & Electric Company, San Francisco, Calif., will make extensions in transmission lines and power substations, distributing system, etc., at Santa Cruz, to cost $500,000. Weyer-haeuser Timber Company, Longview, Wash., has authorized a sulphite pulp mill to cost over $400,000. Public Service Com-pany of Colorado, Denver, plans exten-sions at Valmont generating plant, near Boulder, Colo., to cost $750,000.

NEW ENGLAND

—LITTLE INTEREST IN HEAVY EQUIP-MENT *was noted during the past week. Inquiries in good volume are reported by one manufacturer rela-tive to turbo-generators. Recently a number of small units were placed and control equipment ordered.*

—DIESEL MOTOR SALES *for marine purposes recently noted are of in-terest. Small motors, according to one prominent manufacturer, are steady, though in single orders. Scheduled materials are less active except for some interest in interior lighting effects.*

Contracts for institutional buildings totaling over $5,000,000 will soon pro-vide orders for wiring accessories in good volume. Street-lighting interest is gaining; one manufacturer records sales of street lights and traffic signal devices considerably above the volume reported for last year; further extension of these systems is planned. Of the special equipment lines, marine control equipment is in demand.

CONSTRUCTION PROJECTS

Mount Waldo Granite Company, Mount Waldo, Me., plans electric-operated cut-ting and finishing plant to cost about $50,-000. Public Service Company of New Hampshire, Manchester, contemplates ex-tensions in lines at Lisbon, Bethlehem and vicinity. Harvard University, Cambridge, Mass., has filed plans for a chemical and mechanical laboratory to cost about $1,500,000.

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SOUTHEAST

—FEW ACTIVITIES WORTHY OF COM-MENT *are reported for the South-east. Preparation of 1931 budgets by the larger power companies has served to reduce the volume of busi-ness placed by them, though a few satisfactory wire orders are re-ported.*

A Georgia company ordered $12,200 worth of bare and weatherproof copper wire and a Florida company purchased 50,000 lb. of bare copper wire. A Ten-nessee company ordered 10,000 lb. of No. 2/0 bare copper wire, while another company in the same state has inquiries out on two cars of bare and weather-proof copper wire and it is expected this order will be placed during the coming week. Some other central station or-ders are for $2,000 worth of metering equipment, $1,725 worth of small trans-formers and $1,700 worth of arresters. The only industrial order of any par-ticular size reported was placed by a Carolina textile mill for 1,000 6-hp. motors. One of the leading sign manu-

facturers reports recent orders for a $4,800 installation for a Florida theater and a $6,000 hotel installation in Tennessee, with a satisfactory volume of orders for small installations over the territory as a whole.

CONSTRUCTION PROJECTS

Natural Bridge of Virginia, Inc., Natural Bridge, Va., plans extensions in power plant and installation of additional equipment. Huntington, W. Va., contemplates extensions in lighting system. Mountain Power Company, Tellico Plains, Tenn., has made application for permission to build hydro-electric power plant to cost over $2,000,000. Augusta Canal Company, Augusta, Ga., plans power plant to cost over $800,000, with transmission system. Mississippi Power Company, Gulfport, Miss., plans transmission line from Lumberton to Purvis, Miss. Florida Power Corporation, St. Petersburg, Fla., plans extensions in substation facilities and lines at New Port Richey, Fla., and vicinity.

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MIDDLE WEST

—GENERAL BUSINESS IN THE *Middle West section appears to be making some improvement. A considerable number of favorable indications of the return of normal business are being observed and it is generally felt that the so-called turn has been reached.*

—IT IS EXPECTED *that the figures for the month of November will show an appreciable increase in the volume of business transacted over that of October and the outlook for December is much more promising.*

While the steel industry is doing little more than marking time, the automotive and automotive parts industries show improvement. The railroads are continuing their equipment purchasing and more maintenance material is being bought. Industrial activity still continues somewhat spotty. Retail trade has picked up considerably, due perhaps to pre-holiday purchasing and to the advent of cold weather. The various utility companies are starting as much work as possible in an effort to reduce unemployment, conservatively to plan expansion next year.

CONSTRUCTION PROJECTS

Northern States Power Company, Eau Claire, Wis., plans lighting system at Chippewa Falls, Wis. Ford Motor Company, Dearborn, Mich., plans addition to automobile assembling plant at Long Beach, Calif., to cost about $1,000,000. University of St. Xavier, Cincinnati, Ohio, plans manual training school to cost $350,000. Direct-Action Stove Company, Lorain, Ohio, contemplates additions to cost over $400,000. Interstate Power Company, Dubuque, Iowa, will install ornamental lighting system at Plainview, Minn. Iowa Public Service Company, Sioux City, Iowa, plans extensions in transmission lines at Denison and Cherokee, Iowa. Iowa Railway & Light Corporation, Cedar Rapids, Iowa, plans extensions in transmission lines in Carroll, Boone and other counties. Iowa-Nebraska Light & Power Company, Malvern, Iowa, will make extensions and improvements in local power substation to cost $80,000. Central States Electric Company, Cedar Rapids, Iowa, plans extensions in transmission lines at Wellsburg, Iowa, and vicinity.

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EASTERN

—BUSINESS CONTINUES SCATTERED *in the Eastern district and commitments are at a low level. Incoming inquiries show that restricted sales can be expected for several weeks to come, for buyers are holding quite tenaciously to a hand-to-mouth policy. Such central station demand as now prevails is directed almost solely to substation equipment and line apparatus.*

—MUNICIPAL ACCOUNT LOOMS *as an important factor during the next month or two, and inquiries from that source give prospects of fair-sized contracts.*

General Railway Signal Company has secured the contract for interlocking and signaling equipment for new subway lines, totaling $2,178,000. Railway account is taking a turn for the better, following a valley period for the past six months. Atchison, Topeka & Santa Fe Railway has authorized the purchase of eighteen gas-electric motor cars and will be in the market for other equipment, as well, at an early date. Baltimore & Ohio Railroad Company will install an automatic signal system from Glenwood Junction to Gilkeson, W. Va., and a centralized train control system from the latter place to Wheeling, W. Va., estimated to cost $680,000; work is expected to be scheduled for the early future.

Forthcoming marine account includes a steel Diesel engine-electric tanker for the Atlantic Refining Company, Philadelphia, Pa., to be built at the local yard of the Sun Shipbuilding & Drydock Corporation; there will be three electric generators, with main propelling motor of 400 hp. and triple motorized equipment for regular service and emergencies. New York Shipbuilding Company, Camden, N. J., a subsidiary of the American Brown Boveri Electric Corporation, has contracts for two 30,000-ton ocean liners for the United States Lines, each to cost about $9,500,000.

A central station in northern New York has placed a contract with a state manufacturer for control apparatus, motors and miscellaneous equipment to a sum of $40,000. A metropolitan utility company has purchased motors and control equipment to an amount of $30,000, the order going to a New York maker. A central station in Missouri has placed a commitment for wire aggregating $30,000, about one-half the business being secured by a New Jersey producer. A New Jersey central station has contracted for transformers and accessory apparatus with a New York manufacturer, approximating $35,000. Union Electric Light & Power Company, St. Louis, is in the market for insulators for transmission line service and auxiliary equipment, estimated to cost close to $300,000, and will soon place orders.

CONSTRUCTION PROJECTS

Board of Education, New York, has authorized an industrial school for boys in Brooklyn, to cost over $1,000,000. Brooklyn Edison Company, Brooklyn, N. Y., has authorized fund of $5,000,000 for extensions and improvements in underground conduit system and lines. General Electric Company, Schenectady, N. Y., has plans for factory addition and power plant at Cleveland, Ohio, reported to cost over $200,000. American Can Company, New York, is completing plans for plant at Seattle, Wash., to cost close to $750,000. Department of Hospitals, New York, will soon take bids for power plant at Harlem Hospital, to cost over $250,000. Attica Film Corporation, New York, has filed plans for six-story plant to cost $550,000. New Jersey Bell Telephone Company, Newark, N. J., plans equipment storage and distributing plant, with automobile service and garage unit, at Irvington, to cost over $500,000. Board of Education, Newark, N. J., will receive bids until December 10 for electrical supplies, electric time clocks, air compressors and other equipment. Susquehanna Transmission Company, Baltimore, Md., plans transmission line from Safe Harbor, Pa., to Baltimore and vicinity, to cost over $500,000. Veterans' Bureau, Washington, D. C., will receive bids until December 23 for coal-handling equipment.

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SOUTHWEST

—THE VOLUME OF SALES *in stock sizes of apparatus is probably less than last week, although the number of orders is holding up.*

Contracts were closed for the equipment of a municipal electric plant in southeast Missouri, the amount totaling $123,600, covering two turbo-generators, 600 kva. each; transformers and substation equipment, and $16,000 for standards and other material for a "white way." Two other "white way" jobs are reported, one for $5,000 and the other $1,200. A local power company bought twelve substation oil circuit breakers to cost $5,500.

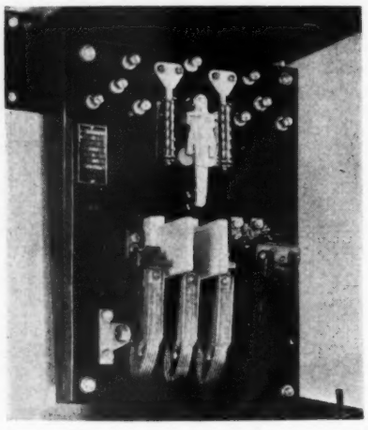
CONSTRUCTION PROJECTS

Kansas City, Kan., has plans under way for installation of additional equipment in power plant. Texas & Pacific Northern Railway Company, Dallas, Tex., plans machine and repair shops to cost $200,000. Santa Anna Glass Company, Santa Anna, Tex., contemplates plant to cost $100,000.

New Equipment Available

Oil-Immersed Starters with Overload Protection

OIL-IMMERSED THERMOLOAD STARTERS, control equipment which gives across-the-line, full-voltage, full-current and full-torque starting with overload and low-voltage protection, have been developed by the Monitor Controller Company, Baltimore, Md. These starters consist of a standard Monitor magnetic contactor, a thermal relay and an oil-tight inclosure. The oil level is such as completely to immerse the contactor and the contacts of the relay, while the thermal elements are mounted above the oil.



In addition to the usual overload protection, this control equipment will disconnect the motor if the voltage fails or drops excessively. It will also insure polyphase motors against damage which results from running single phase, according to the manufacturer.

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Non-Inductive Resistors with Constant Rating

NON-INDUCTIVE RESISTORS, the resistance changes of which are negligible throughout their operating range, have been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Being made of "Zircon," a new ceramic composition, the resistors possess remarkable electrical performance characteristics.

These resistance rods can be used as current-limiting devices with potential transformer fuses where the amount of power is small, as relay and klydonograph shunts, series resistances for measuring sphere gaps, resistors in railway signals, resistors in electrolytic lightning arresters, high resistance shunts for power-limiting reactors, and in surge-testing circuits and a.c. and d.c. testing outfits.

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Solderless Connectors

SOLDERLESS CONNECTORS for use at points where several services must be taken from the same pole or rack are announced by Hubbard & Company, Pittsburgh, Pa. This device consists of a grooved solid-copper forging having a split bolt on which is screwed a brass-nut-and-keeper assembly that clamps the line conductor in the groove of the forging. The connector is drilled for two bolts and two conductors may be connected to each of these bolts. This device is said to allow temporary service disconnection at the pole without disturbing other services or cutting wires.

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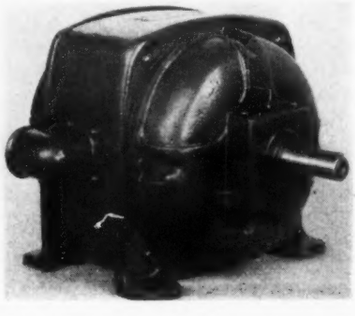
Induction Motors for Reversing Operations

SINGLE-PHASE, REPULSION, INDUCTION MOTORS capable of very frequent reversal are announced by the General Electric Company, Schenectady, N. Y. These motors, designated Type SCA, have the same appearance as the Type SCR, general-purpose, single-phase motors and are mechanically interchangeable in all respects with corresponding horsepower and speed ratings of that type.



The control for this reversing motor is very simple, consisting only of a full-voltage, three-pole reversing switch which may be either manual or magnetic. The starting torque of the motor is high, ranging from 225 to 275 per cent of normal full-load running torque.

The Type SCR motors are available in ratings ranging from ¾ to 5 hp. at 1,800 r.p.m. and from ½ to 2 hp. at 1,200 r.p.m.

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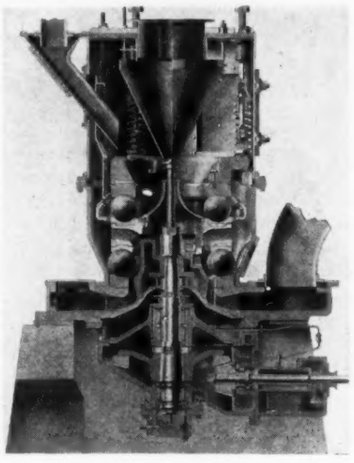
Ring-and-Ball Coal Pulverizer

AIR SEPARATION COAL PULVERIZERS which utilize the spherical-ball and grinding-ring principle of pulverizing, in which fineness is not affected by wear of grinding parts, and which do not have parts in the grinding zone that require lubrication, are announced by the Fuller Lehigh Company, Fullerton, Pa. This pulverizer, designated Type B, has no metal-to-metal abrasion of grinding parts, and wear results only from coal abrasion. The balls wear spherically and the mill has exceptionally low maintenance and power consumption, according to the manufacturer.



The grinding elements consist essentially of two rows of large diameter steel balls and two stationary and one rotating steel grinding rings. The rows of balls, one of which is mounted above the other, are separated and propelled by the rotating ring, which is driven by the main driving shaft on which it floats.

All bearings and gears of the Type B pulverizer are effectively sealed and are lubricated by an automatic force-feed oiling system. The pressure on the grinding mechanism is adjustable and the mills are generally adjusted for a fineness of 65 to 70 per cent through a 200-mesh screen and not over 2 per cent which will not pass through a 50-mesh screen. These machines are built in capacities up to 40 tons of coal per hour.

Details of the heavy cast-iron and steel-plate construction may be seen in the illustration.